

THE DENTAL PRACTITIONER AND DENTAL RECORD

Including the official reports of the British Society of Periodontology, the British Society for the Study of Orthodontics, the European Orthodontic Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis

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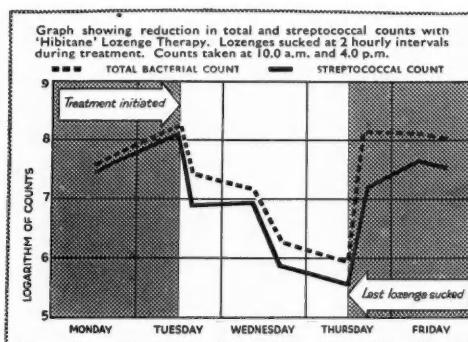
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THE DENTAL PRACTITIONER

AND DENTAL RECORD

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THE DENTAL PRACTITIONER AND DENTAL RECORD

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EDITORIAL



RESEARCH SPACE

MOST Universities and Institutions find there is a pressing need for more research space as the calls from industry and Government departments become more and more insistent. The future of this country is in actual fact dependent upon present research, both academic and applied. Although it has been said that "the best research came out of a cellar", the vast amount of modern routine research requiring highly complicated apparatus invalidates this conception. Granted that many of the great research discoveries have been based on the genius of one man with a perception beyond the normal range, working in cramped surroundings with the minimum of equipment, the fact remains that the application of such ideas depends upon groups of research workers in large buildings. The germ of an idea conceived in a small back room requires careful tending if it is to be brought to fruition, and large-scale research to be undertaken if it is to change the course of history. The spirit of the "cellar" is still required but the application requires space, time, and manpower, as well as the essential co-operation of many able branches of research. This applies to dentistry as to all sciences. While we must praise our famous men for their noble work in the back rooms of their surgeries,

we must also equip modern research laboratories to take such instruments as the electronic microscope. We note with pleasure that the Minister of Health recently opened The London Hospital Research Building and that this new block incorporates a special section of dental research laboratories. This is of exceptional interest as it highlights the integration of dental research with the many and varied aspects of other medical and surgical branches. It is hoped that this pattern will be followed where possible by other hospitals building research laboratories, and that the importance of dental health and research will take its rightful place in the field of medical sciences.

This issue of *THE DENTAL PRACTITIONER* is greatly enlarged owing to the inclusion of several orthodontic articles.

Orthodontics is a rapidly expanding branch of dental practice and more and more dentists are taking a lively interest in the specialty.

The British Society for the Study of Orthodontics have a number of papers awaiting publication, and in order to expedite their appearance they are making themselves financially responsible for the extra number of pages in the present issue.

VACUUM INVESTING AND THE USE OF A MODIFIED APPARATUS

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Senior Lecturer, Department of Conservative Dentistry, Institute of Dental Surgery, Eastman Dental Hospital

INTRODUCTION

NODULES or bubbles on the surface of inlays and other dental castings are one of the important factors in preventing an accurate fit of the casting on the tooth. Coleman, as far back as 1928, described an experimental apparatus for mixing investment under vacuum and found that castings made with this investment were bubble free and showed none of the usual surface roughnesses. Although mentioned again by Granger (1940) and Souder and Paffenbarger (1942), it was probably the wartime use of the method in industry for the production of precision castings, and its subsequent wider peacetime exploitation, that led to the appearance of several vacuum units on the American market designed for dental use (Hollenback, 1948). More recently, Lyon, Dickson, and Schoonover (1953) have described how ninety-five out of a hundred vacuum invested castings were free of casting defects as against only seventeen obtained by a careful conventional paint-on technique.

The technique is still not as widely used as it might be, possibly because the benefits are not well known and possibly because of the mistaken idea that complicated and expensive apparatus is required to work the method.

It is the purpose of this article to review briefly the principles of the application of vacuum investing, to discuss the types of apparatus available, and to describe a simplified yet efficient method using an assembly which can be made up in the average dental laboratory.

PRINCIPLES OF VACUUM INVESTING

In spatulating investment by hand a large amount of air is trapped in the mix in the form of small bubbles. This is considerably reduced if the mix is mechanically spatulated, but, nevertheless, it will still contain an appreciable

number of air-bubbles which are liable to attach themselves to the surface of the wax pattern. Vibration may eliminate some of the bubbles but, if continued for too long a time after investing the pattern, it may even aggravate the condition by causing more bubbles to rise and be trapped around irregularities in the contours of the wax pattern. Surface-tension reducers are a great aid in hand investment methods, but the whole procedure is one requiring considerable care and skill which, unfortunately, is often insufficient to ensure the desired perfect result.

However, if a mix of investment is subjected to a vacuum before it has set, any trapped air-bubbles will tend to expand under the reduced pressure and seek to escape from the mix. Vibration will, of course, assist this process. If the degree of vacuum is increased, any air dissolved in the water will come out of solution. On reducing the pressure still further to 29-30 in. of mercury, the water will actually boil at room temperature. Both these processes will assist the removal of any residual trapped air.

What actually happens if a bowl of investment is placed under a vacuum bell-jar and the vacuum quickly applied is that the mass immediately begins to rise and foam violently as the air is driven off. As the major amount of trapped air is released, the mixture suddenly drops back into the bowl but continues to bubble. This phase now represents dissolving air coming out of the water, which may be followed by the actual boiling of the water in the mix. On release, the mass completely subsides.

The amount of air incorporated into a normal mix of investment can be readily demonstrated in a number of ways. For instance, Campbell (1948) describes how an equal quantity of the same mix of investment can be placed in two

test-tubes. After subjecting one to a vacuum, it will be seen that the level of the investment in the vacuumized tube has dropped by about one fifth. Phillips (1947) has demonstrated the greater density of vacuumized investment by means of the air-flow meter. A tube of treated investment can be compared with a similar untreated one by measuring the amount of air passed through in a given time under similar pressure. This test shows that vacuum-treated investment has a greater density and it is not surprising to find that it also has a higher crushing strength. In regard to this increased density, Lyon and others (1953) found that a proportion of their vacuum-invested castings in preliminary trials showed porosity. This was thought to be due to the lack of escape for the air displaced by the inrushing gold. The difficulty was overcome by using a large reservoir on the sprue and placing the casting not more than approximately $\frac{1}{4}$ in. from the end of the ring. However, in the author's experience porosity has not proved a problem.

Another simple way to demonstrate the elimination of air from a vacuum-treated investment mix is to press some investment between glass plates and observe the air-bubble concentration by transmitted light. Vacuumized investment will be seen to be very much freer than normal investment.

However, the most convincing demonstration of the value of vacuum-investing technique is in the finished castings. Not only are the vast majority completely free of nodules and surface imperfections, but the surface of the gold seems to be denser in appearance. Although bubble-free castings can be obtained by conventional methods, it requires considerable care and skill; the vacuum method enables excellent castings to be obtained routinely with a minimum of skill.

APPLICATION AND APPARATUS

The prospective user of the vacuum-investing method may be bewildered by the variety and types of apparatus available. It may be helpful to consider first the source of the vacuum and then to analyse the investing technique stage by stage, in order

to see where and how the vacuum can be applied.

The vacuum required is about 26–28 in. of mercury. The simplest way of obtaining this is by a water-pump, costing anything from a few shillings for a glass laboratory filter-pump to £2–£3 for a metal pump with gauge (Edwards High Vacuum Limited, Crawley, Sussex). This type of pump will run off a mains water tap to which it may be attached by a union cap or stout rubber tubing. Most mains supplies are adequate, but taps supplied from storage tanks may have insufficient head of water to work the pump satisfactorily. If water-pressure is not available, an electric vacuum-pump must be employed. These are, of course, much more expensive and are of two main types. One will evacuate a 6 in.-diameter bell-jar to $29\frac{1}{2}$ in. of mercury or more in 10 seconds, while the less powerful type will establish, in the same size vessel, a vacuum of 28 in. of mercury in 15–20 seconds. Generally, as will be seen later from consideration of investment apparatus, it is advisable to obtain the greatest possible vacuum as quickly as possible. It is interesting to note that both types of pumps can be obtained with a compressor combined in the same apparatus to give a pressure of 7–15 lb. per sq. in., sufficient for blow torches, atomizers, etc.

A consideration now of the investing process will show that there are four stages during each of which it may be possible to apply a vacuum. These are during:—

1. The mixing together of investment powder and water.
2. The period after the investment is mixed and before the pattern is invested.
3. The actual investing of the pattern in the ring.
4. The period after the investing, before the investment has set.

One of the most obvious ways of applying a vacuum is by what may be called the chamber method, and most of the apparatus available in this country works on this principle. The apparatus (Fig. 1) consists usually of a glass bell-jar or chamber resting on a rubber-covered metal base (Ireland, 1949). This

allows a proper seal to be made when the vacuum is applied. The vacuum inlet is usually made to come up through the base and is normally covered by a metal platform on legs. This serves three purposes. It allows the base and thus the volume of the chamber to be kept as small as possible by utilizing

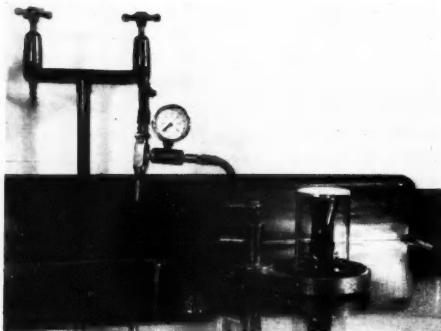


Fig. 1.—Chamber-type vacuum apparatus connected to water-jet vacuum-pump.

the whole of the floor area of the chamber; it prevents any spilt investment from entering the vacuum system; and, thirdly, it disperses the blast of air which enters the chamber on release of the vacuum which might otherwise upset the inlay ring.

The alternative type of chamber apparatus described by Campbell (1948), utilizing an air-tight jar, is easier to construct but more cumbersome to use. First, the inlay ring assembly has to be carefully lowered into the jar and then the top screwed on or otherwise firmly attached. This method was early discarded in favour of the previous apparatus.

A valve or tap is incorporated in the vacuum line from the pump whereby air can be let into the system before the pump is turned off. If a water-pump is turned off before breaking the vacuum, water will be sucked back towards the chamber, unless a non-return valve is incorporated. If a motor-pump is being used it is also bad practice to turn this off before releasing the vacuum. A quick release is necessary in order to obtain the rapid subsidence of the bubbling investment, which, it

should be remembered, is becoming more viscous as it begins to set.

With such an apparatus it is obviously impossible, without complicated modifications, to apply the vacuum in Stage 1 referred to above, i.e., the water and powder cannot be mixed under vacuum. Theoretically, the vacuum may be applied in the second stage with the mixed investment remaining in the bowl before being transferred to the inlay ring. However, even if air is eliminated at this stage, it may well be incorporated during the pouring of the investment into the ring around the pattern, requiring another vacuum treatment. Since the investment is setting all this time, in practice it is not usually found possible to apply the vacuum in Stage 2. Nor of course can the investment be manipulated into the inlay ring (Stage 3) under a bell-jar without employment of additional complex apparatus. Thus vacuum investing with the chamber method is practically confined to Stage 4. Here the normal investment procedure is followed until the ring is filled. Then an extension tube or cone is attached by a rubber collar, or some other means, to the ring and more investment poured in to overfill the original inlay ring. The assembly is quickly placed in the chamber and the vacuum applied. The extension now prevents the investment from being spilt during the expanding, foaming stage, and ensures that the inlay ring is full at the end of the process. If this technique is not employed one is apt to find, after releasing the vacuum, a half-empty ring with an exposed pattern. The quick release may again be emphasized as helping to ensure that the investment is well consolidated back in the ring. In addition, the base of a chamber type apparatus is often set on springs or rubber feet, which allow jarring or coarse vibration of the whole assembly to aid the expulsion of air from the mix.

This method of vacuum investing works quite satisfactorily, although it has the disadvantage that it is more difficult to employ a really thick mix of investment when maximum expansion is desired. In this case, much of the trapped air has to be drawn up in effect through a narrow tube of thick investment,

which is in a state nearing the commencement of the initial set. A powerful, quick acting pump is thus desirable for maximum efficiency with chamber type apparatus.

There are a number of American systems of vacuum investing in which all four stages of investing are carried out under vacuum. These techniques are well described and illustrated by Tylman (1954). They entail the use of special mixing paddles and bowls, capable of withstanding the vacuum. The spatulation of the investment is carried out under vacuum with the bowl and mixer held sideways against a driving motor, with the inlay ring and special sprue base attached either to the base of the bowl or eccentrically on the paddle assembly. When the mixing stage has been completed, the bowl is tilted to fill the ring, the vacuum still being maintained. However, this ideal method does necessitate fairly complex equipment and all pieces of it must be kept in first-class condition, otherwise there may be a break-down in the vacuum system.

The complications associated with these techniques and the drawbacks of the simple chamber method have led to the development of the following modified apparatus, which has been successfully employed at the Institute of Dental Surgery for a number of years. It has the added advantage that it may be made up quite easily in the average dental laboratory.

THE MODIFIED APPARATUS

A glass bottle or jar of approximately 4 oz. capacity is obtained with an opening somewhat larger than the diameter of the inlay ring to be used (*Fig. 2*). A hole is drilled in the bottle near the shoulder by means of a mounted carborundum stone, kept moist with turpentine. A connector should then be cemented into the hole to which some thick walled rubber tubing can be attached. Next, a rubber connector should be constructed to attach the inlay ring to the neck of the bottle as in the diagram (*Fig. 2*). This may be made by forming a wax collar to fit around the neck of the bottle and a similar one to fit around the edge of the inlay ring. The two collars are then joined together. The wax form is

now flasked and packed with motor-car inner tube repair compound (Goodyear). This is vulcanized for fifteen minutes at thirty pounds pressure and produces a tough, flexible rubber joint. In the same manner, rubber sprue bases may be formed according to the pattern shown in *Fig. 2*.

In order to break the vacuum rapidly, and generally to control the apparatus, a vacuum tap, allowing entry of air into the

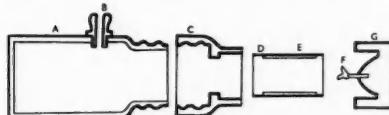


Fig. 2.—Exploded cross sectional diagram of modified apparatus. A, Glass bottle; B, Connector for tube from pump; C, Moulded rubber connector; D, Inlay ring; E, Asbestos liner; F, Sprued inlay pattern; G, Moulded rubber sprue base.

system, should be inserted in the pipe-line between the bottle and the source of vacuum; if a motor-pump is used it is also a wise precaution to add a bottle trap to catch any investment or moisture which might accidentally be sucked up through the tubing. All tubing should be thick-walled and of small bore to reduce the dead space to be evacuated.

Procedure.—The sprued pattern is assembled on the sprue base with the inlay ring and the asbestos liner in the normal way. The investment is mixed in a rubber bowl, preferably with a mechanical mixer. After thorough mixing it is poured quickly into the glass bottle. This is best achieved by placing the bottle on a vibrator and allowing the edge of the mixing bowl to rest on the rim of the bottle (*Fig. 3*). Care must be taken to keep the vacuum outlet uppermost and well clear of the investment. The rubber connector is then slipped on to the bottle and the inlay ring assembly inserted into the connector (*Fig. 4*). The vacuum is applied and the bottle vibrated while holding the assembly nearly horizontal (*Fig. 5*). This presents a large surface-area of investment to the vacuum and enables the air to escape rapidly. Even a thick mix of investment may be successfully treated by this method. At this stage, no investment is allowed into the inlay

ring. After the major amount of air is evacuated the investment is allowed to continue bubbling for 10-15 seconds. Then the whole apparatus is tilted so that the investment flows out of the bottle and fills the inlay ring,



Fig. 3.—Use of vacuum apparatus. Stage 1: Pouring investment into the bottle under vibration.

This modified vacuum-investing apparatus and technique has the advantage of being simple to construct and operate. It also takes maximum advantage of the vacuum obtainable by presenting a large surface-area of



Fig. 4.—Use of vacuum apparatus. Stage 2: The rubber connector has been placed on the bottle. The inlay ring and sprue base are now inserted into the connector.



Fig. 5.—Use of vacuum apparatus. Stage 3: The vacuum is applied with the assembly nearly horizontal.



Fig. 6.—Use of vacuum apparatus. Stage 4: Assembly is inverted to fill ring with vacuumized investment.

the vacuum and vibration still being maintained (*Fig. 6*). When the ring is full, the vacuum is broken quickly by opening the tap. As previously mentioned, it is important always to break the vacuum before switching off the vacuum source. The bottle and connector are then gently removed from the inlay ring, which is still held on the vibrator, care being taken to avoid sucking investment from the inlay ring.

investment for release of trapped air, and probably reasonable results would still be obtained where a low vacuum made the chamber method unsuccessful. In addition, the investing process is carried out entirely under vacuum apart from the initial mixing stage.

If ever nodules do occur on the resulting casting they can usually be traced to a leak around the sprue base or to the spruing of

the pattern at an incorrect angle in the ring. The aim should be to avoid presenting a concave surface of the pattern directly towards the base of the ring, but to angulate the pattern so that all rising bubbles will tend to slide off it without being trapped. Even vacuum may fail to extract some bubbles if the angle of the pattern is unfavourable.

SUMMARY

The principles and application of vacuum investing for small dental castings are considered. The various types of equipment are mentioned together with a suggested modified apparatus having certain advantages. Its construction and the detailed procedure for its use are described.

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THE PROTECTION OF EXTRACTION WOUNDS*

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THE healing of extraction wounds is complicated by their peculiar environment in the mouth. The chewing of food and the explorations of the tongue are disturbing factors, which, together with the septic surroundings, tend to interfere with healing. Indeed, extraction wounds seem to be more deserving of protective dressings during healing than wounds in other parts of the body which are usually covered in some way.

Recently, during a systematic appraisal of a series of cases in the first few days following extractions, it was evident that many patients suffer a considerable, though not intolerable, degree of discomfort. In normal circumstances these patients would not have been seen by a dentist, and their troubles would have remained unknown.

It was noticeable also that among patients who had immediate dentures, pain associated with sockets was rare compared with those others who had been left with sockets unprotected in what one must describe as "the usual way". This usual way of the dental

profession is, after all, quite unusual in terms of general surgical practice.

WOUND HEALING

The extraction of teeth involves exposing a considerable area of raw tissue. Fortunately coagulation of the blood quickly occludes the socket and reduces the area at risk.

The formation of a blood-clot is the first stage in the healing of the wound, and forms a scaffold on which connective tissue and epithelium proliferate, later to be replaced gradually by new bone to constitute a residual alveolar ridge. Initially then, the growth of bone in tooth sockets depends upon conditions allowing the formation and undisturbed organization of a blood-clot. Natural protection of this vital blood-clot is afforded by the contraction of the surrounding mucous membrane.

This is seen to be most marked in the case of the removal of a single isolated tooth, where within seven days the area of the wound is reduced considerably. With multiple extractions this natural protection may be less efficient as observed over the same period of time. The removal of projecting spikes of

*From a short Paper read before the Odonto-Chirurgical Society of Scotland on January 10, 1957.

bone, followed possibly by suturing, will assist in obtaining early coverage, however.

But by no means all of the blood-clot formed will remain in an unprotected extraction wound (*Fig. 1*). Breakdown and loss of

between the outer and inner plates of alveolar bone (*Fig. 2*).

Within this depression no new bone can form, but rather will the prominent bony walls tend to resorb, leaving the ridge



Fig. 1.—Sockets of lower left molar tooth on first, third, and eighth days after extraction. Much of the original clot is lost.

the superficial layer to varying depths does commonly occur.

RESIDUAL ALVEOLAR RIDGE

The epithelium, which grows from the margins to seal the wound during the second week, follows the contour of the sound

considerably smaller and less suitable from the prosthetic point of view.

Efficient healing of an extraction wound should result in the formation of a sound bony ridge, upon which we depend so much as a foundation for an efficient prosthesis. The principle of conservation which the dental profession endorses should not be rejected when teeth are lost, but should be applied thoughtfully to the residual alveolar ridge thereafter.

In wounds healing under a satisfactory immediate denture, disintegration of the exposed surface of the blood-clot is minimized. A sound bony ridge remains after healing, and this is due largely to the protection afforded by the plate.

PROTECTING PLATES

The usefulness of acrylic plates in protecting a blood-clot is demonstrated in the precarious circumstances prevailing when extractions are necessary for known true haemophiliacs. Here, of course, the first problem—that of securing coagulation of the blood—is within the sphere of the haematologist, and may cause considerable trouble. Then the preservation of the

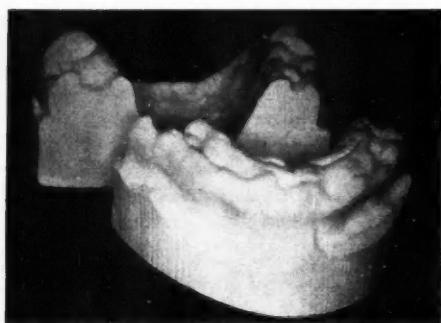


Fig. 2.—Sectioned model of upper jaw fourteen days after extractions. There is a trough between the outer and inner plates of alveolar bone.

organizing blood-clot, so it is inevitable that, when loss of the surface of the clot is severe, there will be a depression in the alveolar ridge

clot depends upon good nursing of the patient and care of the wound.

Control of the socket area can be effected by acrylic plates, provided that they are so designed that they are quite stable in the mouth. Obviously a plate which moves and

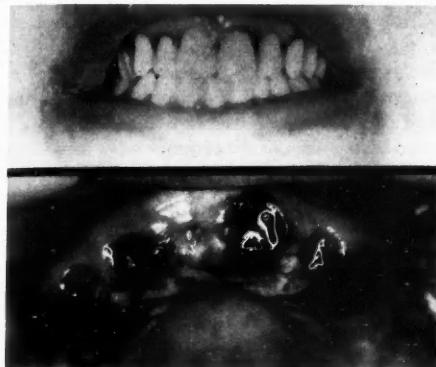


Fig. 3.—Immediate denture in situ and appearance of wounds on day following extractions.

bounces on the wound has an irritant effect, and is a potential cause of recurrent haemorrhage. I have found that difficulties in the retention of haemorrhage plates in haemophilic children, due to the lack of undercut areas in the deciduous dentition, are best overcome by fixing the plates by means of a layer of zinc oxide and eugenol impression paste.

Such a plate has functions similar to wound dressings in other parts of the body—allowing a clot to form and protecting the wound from further injury. (Fig. 3.)

In normal cases, immediate dentures serve the same purpose as haemorrhage plates. By their use the whole blood-clot can be retained intact, and new bone may fill the whole socket, forming initially a ridge favourable to the efforts of the prosthodontist. Their protective function also ensures a degree of comfort in the post-operative period which is gratifying and astonishing to the patient—and at times to the operator also. But, like haemorrhage plates, immediate dentures must be stable or they will do more harm than good.

THE DESIGN OF IMMEDIATE DENTURES

For a stable prosthesis good design is essential.

The design of the occlusal and polished surfaces of an immediate denture presents no special problem, but the design of the tissue-fitting surface involves carving a model to represent the shape of the ridge to be expected after the teeth have been removed. This requires guess-work, but it should not be left entirely to chance since it is largely upon the accuracy of this assessment that the success of the denture will depend.

It is interesting to compare models of the mouth before extractions with models of the same mouth seven or ten days later. The result is surprisingly variable, depending on the pre-extraction condition of the structures supporting the teeth, and in particular the amount of bone lost owing to periodontal disease. In order to carve a model to a form appropriate to the individual case, one must be able to form a mental picture of the probable relationship of the tooth crown and root to the surrounding tissues.

The plaster model gives little indication of the conditions prevailing beneath the surface, but an interpretation of clinical signs—tooth mobility and pocket depth—and possibly radiography, give helpful clues. Clinical experience is necessary to translate these pre-extraction indications into a conception of the expected post-extraction appearance. Certainly the preparation of models can be undertaken reasonably only by the clinical operator.

The design and prescription of appliances is a function of the dental surgeon. That is a principle to which we must all subscribe if prosthetics is to be a professional service.

The stage of model trimming for an immediate denture is, in fact, the time at which the design of the baseplate is decided, so the dental surgeon must be responsible for the preparation of the model. The technician then constructs an appliance accurately adapted to the given model.

The conventional method of removing one plaster tooth at a time and setting an artificial one in its place before removing the next cannot be used if the dentist carves the model

and the mechanic sets the teeth. So I favour a method whereby all the plaster teeth are removed at once and the model trimming is done by the dentist, and the mechanic receives, in effect, a model of the edentulous mouth. This system is very satisfactory in practice.

The depth of socketing of artificial teeth should be influenced by the consideration that



Fig. 4.—Lower immediate denture with transparent acrylic flange, and appearance of mouth on day following extractions.

any part of a tooth socket occupied by acrylic resin cannot hold blood-clot, and eventually no new bone will be formed therein. Indeed, the fitting surface of the denture seems to mould the ridge to its own shape.

A well-designed immediate denture will allow of the formation of a complete blood-clot, avoid pressure on the mucous membrane, and offer protection to the extraction wounds. When flanges are used on immediate dentures—more usually in replacing posterior teeth, or with advantage in the lower anterior region—model trimming is planned especially to avoid compression of the gum margins. Limited alveolectomy—the removal of prominent spikes of bone—is at times a necessary expedient (*Fig. 4*).

I submit that to provide protection for extraction wounds offers considerable advantages, and the immediate denture is the most practicable means of doing this. If well designed, it ministers to the comfort of the patient, and the dentist must shoulder

responsibility for the design. If the denture is comfortable and stable it will conserve the blood-clot and favour the formation of a sound alveolar ridge.

Of course, the conservation of alveolar bone is dependent on many other factors such as judicious timing of extractions, skilful removal of the teeth, and sound prosthetic management, for instance. But immediate dentures can play a part by assisting the healing process to produce a full quota of new bone, and if this were its only advantage I think it would be sufficient to commend its use.

Considerations of mandibular placement, efficient function, and æsthetics add weight to my conviction that immediate denture service is the only acceptable method of prosthesis when it becomes apparent that the natural teeth can no longer be retained.

SUMMARY

Efficient healing of extraction wounds should be not only free of unpleasant complications, but should result in the formation of an adequate and sound residual alveolar ridge to facilitate prosthetic restoration.

A sound blood-clot is a necessary precursor of bone growth within the sockets, and the provision of some protection for the organizing blood-clot helps to avoid loss of the superficial layer of it. Protection, as provided by acrylic plates in the control of haemorrhage in haemophiliacs, may be applied in normal cases by the use of immediate dentures.

The design of the baseplate is of prime importance to the success of the denture in function and as a wound dressing in influencing the shape of the residual alveolar ridge. Design of appliances is within the province of the dental surgeon, and to control the design of the baseplate of an immediate denture the dental surgeon himself must carve the master model prior to the technician setting up artificial teeth. Compression of marginal mucosa by the denture and displacement of blood within the sockets by unduly deep "socketing" of artificial teeth should be avoided. Immediate denture service is, from many points of view, the most efficient method of prosthesis.

DENTAL SURGERY AND THE DIABETIC PATIENT

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It is important that a dental surgeon should recognize the presence of diabetes in a patient on whom he is going to operate, no matter how small the surgery, because of certain risks. A simple description will therefore be given of some of the more common general and local signs and symptoms of the disease which help in diagnosis. Surveys of the population indicate that in every three hundred patients one is known to have diabetes. There is a family history of diabetes in one quarter of patients, and obesity is a potent precipitating factor. Though destruction of the islets of Langerhans in the pancreas which manufacture insulin may in some cases explain the onset of diabetes, in most cases the cause is not as simple as this and probably lies in a more general disturbance of the endocrine control of carbohydrate metabolism, resulting in hyperglycæmia (high blood-sugar) and glycosuria (sugar in the urine) amongst other things. The onset of symptoms of diabetes is usually insidious and the disease is sometimes only discovered by chance examination of the urine. The commonest symptoms are polyuria (the passage of excessive amounts of urine), polydipsia (excessive thirst), fatigue, and loss of weight. Together with these, other infections may be present such as carbuncles, boils, and styes.

The oral manifestations may be periapical or periodontal abscesses, dryness and burning of the tongue with enlarged fungiform papillæ, and in the later stages the sweetish characteristic odour of acetone in the breath. Dental infections will, like infection in other organs, always make the diabetic state worse and may produce manifest symptoms in a patient in whom the disease may previously have been latent. There are no specific changes in the mouth resulting from diabetes, although where no treatment is being given, the patient may have periodontoclasia with suppurating gingivitis. The age group of such patients is

usually between the fourth and fifth decade of life, when the incidence is the highest, but the disease can occur at any age. In those cases where diabetes is suspected urine examination and blood-sugar estimations will establish the diagnosis. If the dental surgeon suspects that his patient has diabetes which has not yet been diagnosed he would be wise to refer the patient to a physician for the diagnosis to be confirmed without undertaking further treatment.

Diabetics are all advised on dietary measures which provide them with a diet often slightly less in total calories than that of the normal person with a particular restriction of the intake of carbohydrates. If the patient is under medical treatment his disease will be controlled by dietary restriction of carbohydrate alone or by dietary restriction and insulin. Inadequate control may result in the development of ketosis whilst on the other hand overdosage with insulin gives rise to hypoglycæmia (abnormally low blood-sugar). Both these conditions may lead to unconsciousness. The differential diagnosis between diabetic coma and insulin coma is that in the former the patient is dehydrated, the skin and mucous membranes are dry, the patient gasps for air (air hunger), and the breath has the characteristic odour of acetone; the blood-pressure is low and the extremities are cold. As regards treatment, diabetic coma will require immediate injection of insulin, restoration of fluid loss, and correction of electrolyte disturbance, whereas hypoglycæmic coma requires treatment with sugar either orally or intravenously.

Where any oral surgery is to be performed, this should be carried out under the joint supervision of a dental surgeon and a physician in a hospital. If this facility is not available ketosis must be avoided and by the careful choice of anaesthetic, post-operative complications prevented. For those patients whose

diabetes is controlled by diet alone, dental surgery is usually best undertaken in the morning without any food having been taken beforehand. For those on insulin the best time would be two to three hours after the morning insulin injection, allowing for a normal breakfast. This applies both to cases which are to be done under local anaesthesia (which must not contain more than 1 in 75,000 concentration of adrenaline), and also to the majority of cases requiring a general anaesthetic since the risk of both ketosis and hypoglycæmia developing is minimized by these measures. The alternative is to give dental treatment early in the day and postpone the patient's usual routine insulin and meal by a few hours until such treatment has been given, the patient and doctor keeping a careful check on the urine tests in the following days and making any necessary adjustments in the diet or insulin. As the insulin is balanced in its action against the intake of food during the day it is important that the patient does not miss a meal. If he does have to miss a

meal because he is unable to chew he should take the equivalent food value of the meal in liquid form—diabetic diet sheets which the patient should have given instructions as to the equivalent amount of milk and fruit drinks which the patient should take to avoid any chance of developing hypoglycæmia from insulin if his usual meal is missed. The management of the diabetes is very much easier when local anaesthesia, rather than general anaesthesia, is used.

Post-operative complications will be minimized if vitamins B and C are given, together with antibiotics. Ascorbic acid in 100 mg. doses three times a day commencing a day before operation will prevent a lot of trouble. The surgery must be as atraumatic as possible.

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TOOTH ROOT REMOVED FROM THE INFERIOR DENTAL CANAL

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CASE REPORT

DURING an explosion in 1917, Mr. P. A. lost his left arm and received injuries to the left side of his face. Some of his teeth had been extracted two years previously and the broken remnants of the remainder were removed when his facial lacerations were repaired. He stated that his jaw had never been broken, nor had any form of mandibular fixation been worn. Since being wounded his general health had been excellent and he had worn full upper and lower dentures for thirty-nine years.

In early 1956, the patient was referred to this hospital by Mr. D. J. Dalton. He was then a 59-year-old smallholder, who complained of recurrent inflammatory swellings of the left cheek during the preceding two years. Each swelling had lasted for seven to ten days and five such swellings had occurred during the twelve months prior to his first attendance. Since the onset of the swellings he had experienced a dull shooting pain in the left mandible which was always worse during cold weather and had, on occasions, kept him awake at night.

Direct questioning revealed that gradually increasing paresthesia of the left lower lip had been noted for one year.

ON EXAMINATION.—A small area of anaesthesia of the left lower lip was the only abnormal clinical finding but radiographs revealed a radiolucent dilatation of the left inferior dental canal which contained a radio-opaque foreign body (Fig. 1). Tomography demonstrated that the foreign body was lying on the buccal side of the neurovascular bundle and that the buccal plate overlying it was perforated.

AT OPERATION.—Under endotracheal anaesthesia (Dr. H. G. Middleton) an extra-oral incision was made one half inch below and behind the mandibular angle. After division of the facial vessels and reflection of the insertion of the masseter muscle, the buccal plate and angle of the mandible were exposed. The perforation of the buccal plate was easily identified and was used as a guide during the removal of bone by chisel cuts joining small bur holes. This bone removal revealed a granulation tissue sac which, when opened, was found to contain

a small calcified foreign body (Fig. 2). After removing the foreign body with tweezers the abscess sac was shelled out in one piece with a Warwick James angled elevator, leaving the inferior dental vessels and nerve lying intact

surface the cementum shows numerous shallow bays resulting from osteoclastic activity (Fig. 3).

It is probable that the specimen is the apical part of a tooth root.



Fig. 1.—Pre-operative radiograph.

across the bottom of the bony cavity. After removal of bony sharp edges the wound was closed in layers, without drainage, a five-day course of intramuscular penicillin being given.

Healing was uneventful and the patient was discharged home one week post-operatively. When seen recently

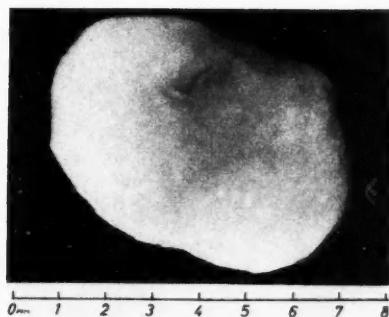


Fig. 2.—The root fragment.

DISCUSSION

Although it is not uncommon to find tooth roots in close relationship to the inferior dental canal, it is rare to find a tooth root actually within the canal itself. The factors influencing a decision to remove such a foreign body are discussed by Oringer (1950).

In the case reported the infection must either have lain dormant for thirty-seven years or have been blood borne and an example of anachoresis, Stones (1954).

Tomography yielded valuable and precise information which allowed an operation plan to be formulated. An occlusal radiograph had failed to yield such information owing to the distal position of the root fragment. The extra-oral approach rendered simple a procedure which would have been formidable had an intra-oral approach been used.



Fig. 3.—Ground section showing dentine (left) and cementum. ($\times 52$.)

he was symptom-free although a diminished area of left labial anaesthesia was still demonstrable.

PATHOLOGIST'S REPORT.—A roughly oval, smooth surfaced, yellow-brown translucent hard tissue mass measuring $6 \times 4 \times 3$ mm.

Both ground and decalcified sections have been prepared. These show that the specimen consists of a small mass of dentine, enclosing a central canal, and entirely embedded in cellular cementum. Over much of its

Acknowledgements.—I gratefully acknowledge the encouragement and assistance received from Messrs. J. L. Gibson and A. L. Schofield, and am indebted to Mr. I. R. H. Kramer for the Pathological report and to Mr. L. Mincher for the photographs.

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A DILATED COMPOSITE ODONTOOME

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DILATED odontomes are not uncommon in the anterior part of the mouth. This specimen shows some points of special interest which merit reporting it.



Fig. 1.—Radiograph of 2 depicting the periapical radiolucent area in association with the enamel lined invagination and not the pulp canal.

It was discovered, on routine examination, in the upper incisor region of a female patient aged 26 years. She was observed over a period of one year four months during which time she had no symptoms. There were no abnormal signs present and the pulp tissue always responded to electrical stimulation.

X-ray examination showed an enamel invagination which extended from a pit on the incisal edge to the apical portion of the tooth. There was in relation to the latter an area of periapical rarefaction following bacterial infection via the abnormal pathway (Fig. 1).

The pulp-tissue had been separated into two interconnected portions, one large and one small, during the development of the invagination. This tissue had remained uninfected as seen in the accompanying section (Fig. 2); it was completely unconnected to the invagination.

The specimen appears to be an example of what Colyer (1926) termed "hooded teeth" (Fig. 23). Rushton (1937) has also illustrated

examples in a paper on these odontomes (Figs. 18, 35, and 36).

The interest in this case rests upon the perfect formation of the invagination and the



Fig. 2.—Decalcified section. Photomicrograph shows position of invagination (enamel lost in preparation), and normal pulp tissue. H. and E. ($\times 24$.)

presence of periapical infection occurring via the invagination, associated with normal pulp-tissue.

Acknowledgements.—I wish to thank Mr. H. M. Pickard for permission to publish the case, Dr. Blackwood for the photomicrograph, and Mr. Shilland for the other photographic print.

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MODERN CONSIDERATIONS IN DENTAL ANAESTHESIA

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In recent years it has become the custom in general anaesthetic practice as a whole to talk of "the balanced anaesthetic". This conception has resulted from the introduction into anaesthesia of muscle relaxant drugs of the curariform type together with the use of systemic analgesic agents to supplement the more conventional forms of anaesthesia.

In this light we can regard general anaesthesia as being a state produced when three distinct pharmacological actions are present simultaneously; these are:—

1. Sleep or *narcosis*.
2. Lack of response to pain stimuli or *analgesia*.
3. Loss of tone in skeletal muscle or *relaxation*.

In any balanced anaesthetic these three elements must be present, each to a sufficient degree to fulfil the requirements of the operation being performed. This approach is eminently suitable as far as out-patient dental anaesthesia is concerned, since the commonly used agents for this type of work—nitrous oxide, oxygen, and trichlorethylene—will produce both narcosis and analgesia, and the third element, relaxation, which is so vital a one in dental work, can be produced not by the curare type drugs, but by the powers of persuasion of the anaesthetist when applied to the conscious patient.

1. Narcosis and Nitrous Oxide.—Nitrous oxide is a weak anaesthetic drug, but it is quite capable of producing unconsciousness even when an oxygen content is added which is more than enough to prevent anoxia and cyanosis. Unconsciousness can be maintained almost indefinitely with a mixture of 20 per cent oxygen in nitrous oxide—the same percentage of oxygen as in normal air—provided that there is no peripheral nervous stimulation. The difficulty arises when a pain stimulus is applied to the patient and reflex responses in the form of movements result.

If such responses can be inhibited then a smooth anaesthesia can be maintained. We must therefore consider the method of prevention.

2. Analgesia and Trichlorethylene.—Trichlorethylene or "trilene" is an analgesic agent in low dosages but a full anaesthetic drug in higher ones. It is, however, essentially the analgesic properties which are of greatest value in dentistry. Much has been written with regard to the use of trilene in dental anaesthetic practice, but the majority of writers have referred to the drug as an adjuvant anaesthetic rather than an analgesic. Successful use of trilene for out-patient work demands low dosage if delayed recovery time is to be avoided and such low dosage must be regarded as being of analgesic rather than of anaesthetic level.

This attainment of narcotic but not anoxic levels of nitrous oxide and oxygen together with analgesic but not anaesthetic dosages of trilene cannot be achieved satisfactorily unless the induction of the anaesthetic is accompanied by the relaxation of the large muscle masses—especially the shoulders, arms, and legs—by the patient. The extent to which this relaxation is successful is determined first by the ability of the anaesthetist to persuade his patient to co-operate, and secondly by the extent to which the patient is capable of following the instructions being given to him.

3. Relaxation and Persuasion.—It is well known that dental operations can be carried out with the patient under the influence of relaxation and hypnosis alone. Such techniques are valuable and can be extremely effective, but are in the majority of instances time consuming and for this and other reasons are unsuitable for many patients and practices. It would be a mistake, however, to assume that just because the more conventional forms of general anaesthesia are being employed, then relaxation and hypnosis have no place in the

management. By combining the immense benefits of relaxation with the certainty of nitrous oxide and trichlorethylene, a technique can be developed for producing a truly balanced anaesthetic upon the un-premedicated out-patient in the dental surgery. Such a technique is really nothing more than what every successful dental anaesthetist does in effect do.

The importance of inducing this state of conscious relaxation in the patient before the actual anaesthetic is commenced cannot be over-estimated. It is quite surprising how much more manageable even the most muscular and allegedly "resistant" patient will become if he can be persuaded to really relax and keep relaxed in his shoulders, arms, and chest. Such a technique is also of great assistance with the apprehensive female who is extremely "keyed-up", with muscles taut, hands clenched, and who commonly fails to follow instructions simply because she is concentrating on "holding tight" on to her emotions. Although of the greatest value in such types of patient relaxation should, however, be applied as a routine to all cases—for only in this way will its immense value be best appreciated.

We may therefore say that a balanced dental anaesthetic is one in which—after securing co-operation and complete relaxation by the patient—unconsciousness is induced with nitrous oxide and oxygen, and analgesia is produced and maintained with trichlorethylene to a level which will inhibit the response to pain stimuli. All practising dental surgeons will know the cases where anaesthesia with nitrous oxide and oxygen alone proceeds perfectly smoothly until the first tooth is extracted, and from then on reflex movement occurs with every extraction. Such patients are unconscious but not analgesic. Trilene in suitable dosage will provide the analgesia, but even then some cases will show muscular rigidity with stiff limbs, and worse still, a tight jaw. These patients are not relaxed and the onus for the relaxation must be placed upon the anaesthetist and not upon the nitrous oxide or the trilene. To attempt to "push" either of these agents in order to produce

relaxation is neither scientific nor safe and will inevitably lead to a delayed recovery.

Nitrous oxide, trilene, and relaxation are, however, not the only combination of agents which may be used to produce a balanced anaesthetic in the dental surgery. Nitrous oxide, in addition to being a narcotic, is also in itself an analgesic drug, as evidenced by the use of "gas and air" in midwifery. Even if administered with amounts of air in excess of 20 per cent the analgesic properties of the gas can be utilized provided that some other agent is employed to produce the narcosis. Such an agent may be one of the short-acting barbiturates such as thiopentone or buthalitone (transithal). When used in combination with agents such as these, nitrous oxide will act in the capacity of an analgesic even in the presence of quite high oxygen concentrations. Furthermore, it should be appreciated that in the dosages used for dental out-patient work neither thiopentone nor buthalitone themselves possess any analgesic powers whatsoever. This realization is important, since the use of these agents alone, i.e., without any "covering" N_2O , is fundamentally wrong, as in the absence of such analgesic properties, doses in excess of those necessary to produce narcosis alone will tend to be used in order to cover up the inadequacies of the barbiturate as a balanced anaesthetic. Administration of the short-acting barbiturates is of course via the intravenous route. The so essential relaxation element of the anaesthetic is thus readily obtained if the patient is instructed to relax consciously after the needle puncture has been made and before the injection itself is commenced. It is wrong to assume that just because this type of agent is being used relaxation is unnecessary.

Experiences with both thiopentone and transithal have shown that, in skilled hands, both drugs can fill a useful place in the armamentarium of the dental anaesthetist. Transithal has a shorter duration of action than has thiopentone and in comparable doses produces a lighter degree of narcosis; it is, therefore, of greatest value in short cases and non-resistant subjects. In long cases and in resistant patients doses in excess of the

optimum may be needed and thiopentone is perhaps the agent of choice. The resistant and often alcoholic subject will metabolize thiopentone readily and delayed recovery is seldom met with if the dosages are kept to strictly narcotic levels. Furthermore, the more gradual elimination of this drug makes for a smoother balance of anaesthesia during the time of the operative procedure.

Premedication.—In out-patient dental practice premedication can also be approached in the light of the balanced anaesthetic.

A premedicant drug may be a mild narcotic, an analgesic, or one which facilitates relaxation. The medium-acting barbiturate group, including nembutal, seconal, and amytal, are pure narcotics and will facilitate the sleep element either of nitrous oxide or of the short-acting barbiturates. Furthermore, analgesics such as codeine, aspirin, and pethidine will act as potentiators of the analgesic properties of trilene or of nitrous oxide itself; although in the case of pethidine care must be exercised as it also has addictive properties and should not therefore be prescribed for routine cases.

Much publicity has recently been given to the so-called tranquilizing drugs, and many trade preparations are now available on the

market, i.e., oblivon and largactil. Such drugs may have a value in helping to produce a frame of mind in the patient which will make him more amenable to the persuasive powers of the anaesthetist—thus making relaxation more effective.

This approach to premedication shows that the theory of the balanced anaesthetic can be applied to all aspects of the problem, and by selection of the best type of premedication the actual administration of the anaesthetic can be facilitated in any one or more of its three components.

SUMMARY

Dental anaesthesia has been reviewed in the light of the modern conception of balanced anaesthesia. In this way it is possible to adopt a more scientific approach to a subject which for a generation has been regarded merely as a "side line". The scope for improvement of techniques with resulting better operation conditions and reduced post-operative morbidity of patients is vast when one considers the country as a whole, and no important advance can take place until an approach to the subject which is something more than a rule-of-thumb method is adopted by both dentist and anaesthetist alike.

A Study in the Development of an Electronic Technique to measure the Forces exerted on the Dentition by the Perioral and Lingual Musculature

This research was a study in the development of an electronic technique for measuring the forces exerted on the dentition by the lips, cheeks, and tongue. This method utilized the SR4 resistance strain gauge. This type of strain gauge depends for its operation on the fact that the electrical resistance of a metallic wire changes as it is subjected to strain. The usual form for the resistance strain gauge consists of resistance wire wound back and forth in the form of a grid which is cemented between two pieces of thin paper. This gauge is bonded securely with cement to the member to be strained, so that any strain in the member is transmitted to the wire. Consequently,

any strain in the member is measured by measuring the change in resistance of the wire, and results in a linear function. The gauge carrier which contains the elastic unit to which the strain gauges are attached was constructed in type "C" inlay gold. Five areas of the mouth were selected for survey. Seven subjects with excellent occlusion were investigated. There is no apparent increase of pressure on the buccal surface of the maxillary first molar or the labial surface of the maxillary central incisors during the act of swallowing. There is an increase of pressure on the lingual surface of the mandibular first molar during the act of swallowing. There appears to be more pressure exerted on the dentition by the tongue than by the buccal musculature during speech.—WINDERS, ROBERT V. (1956), *Amer. J. Orthodont.*, 42, 645.

FRACTURE OF THE CORONOID PROCESS DURING EXTRACTION OF LOWER THIRD MOLAR

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CASE REPORT

MR. G. G., aged 39, was seen on June 21, 1956, having been referred by his doctor for the treatment of trismus associated with pain and swelling of the right side of the

with intramuscular penicillin for one week. Relief was obtained for a few days but there was a recurrence of symptoms four days before attending the Dental Department. No further treatment with antibiotics had been given.



Fig. 1.—Fracture of the coronoid process during extraction of lower third molar.



Fig. 3.—Fracture of the coronoid process during extraction of lower third molar.

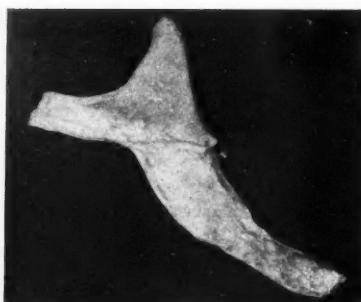


Fig. 2.—Fracture of the coronoid process during extraction of lower third molar.

face. The $\overline{8}$ had been extracted with difficulty under local anaesthesia by his dentist three weeks previously. The symptoms first appeared one week after the extraction, when the patient was seen by his doctor and treated

ON EXAMINATION.—There was a firm diffuse swelling about the right angle of the jaw and right submandibular region. Opening was limited to one fingerbreadth and there was some discharge of pus from the $\overline{8}$ socket. There was no numbness of the lower lip. The patient was of a robust type and did not complain of undue pain or malaise; his temperature was 98.8° F.

Radiographic examination showed changes suggestive of an area of osteitis around the $\overline{8}$ socket with a horizontal fracture of the alveolus starting in the $\overline{6}$ region, extending posteriorly into the ramus and then superiorly towards the condyloid process (Fig. 1). There was no displacement, and owing to the time which had elapsed since the injury it was considered that immobilization of the jaw would serve no useful purpose.

The patient was given intramuscular injections of 600,000 units of procaine penicillin daily and the socket was irrigated with saline. The pain and swelling subsided in 48 hours, but the discharge continued, and after one week the patient complained of a slight loss of sensation on the right side of his lower lip.

Further X-rays showed that the area of osteitis was spreading and to avoid a more generalized osteomyelitis

through the involvement of the inferior dental vessels the patient was admitted to hospital for operation.

AT OPERATION.—On July 4, by intra-oral approach under endotracheal anaesthesia, the infected bone around the socket was curetted away down to bleeding bone, resulting in exposure of the inferior dental vessels and nerve. The fractured segment of bone was found to be loose, and in view of the extent and duration of the infection it was decided to remove it. On dissection it was found to include the lingual plate of the alveolar bone, the anterior half of the ramus with the coronoid process, and a small portion of the base of the condyloid process (Fig. 2). The wound in the mouth was carefully repaired and the region of the $\overline{8}$ socket drained by insertion of a corrugated rubber drain extra-orally. The jaws were immobilized by interdental wiring and the patient was given terramycin for seven days. The drain was removed after two days and, except for post-operative oedema for four days, recovery was uneventful, the patient being discharged from hospital after one week. The eyelet wiring was removed one week later and the condition of the bone four weeks after operation is shown in Fig. 3. At that time movement of the jaws was normal and sensation was returning to the lower lip.

COMMENT

This type of fracture does not appear to have been reported previously, but one of us (R. I. H. W.) has seen a similar accident on

two occasions during the removal of impacted third molars by the "split bone" technique. In this case forceps alone were used during extraction and considerable force must have been applied. If the mandible had been immobilized by intermaxillary eyelet wiring and antibiotic therapy started at the time of extraction, it is probable that the fracture would have united without further trouble. However, by the time that penicillin was administered, infection had become well established, with the result that although the symptoms were suppressed the condition was not cured. There was no direct evidence that penicillin-resistant organisms were present following the two courses of penicillin, but it was thought advisable to use terramycin instead of penicillin post-operatively.

This case illustrates the importance of adequate X-ray pictures in the diagnosis of post-extraction complications and emphasizes the limitations of antibiotics in the treatment of infections of the jaws.

An Innovation in Technique for Dental Gas

An innovation in the technique of administration of nitrous oxide is described for which the term "amnalgesia" has been coined. The success of the method depends on the establishment and maintenance of nasal breathing. After two or three breaths of nitrous oxide (Jectaflo machines were used) pressure is slightly increased and the rebreathing bag switched into the circuit for some four more breaths, when the apparatus is set immediately to 15 per cent oxygen (older children and adults 20 per cent oxygen). Some forty breaths are required to reach the condition of amnalgesia which is recognized by "free" and regular breathing, relaxation of eyelids with eyeballs expressionless in conjugate deviation, the patient being a bright pink colour. There may be some phonation during extractions, but it is claimed that there is no memory of pain or loss of teeth, and that, although induction is somewhat longer, operating conditions are much smoother and the recovery time in the chair much less. It is suggested that with the tough adult male

some supplement of vinyl ether or trichlorethylene may be indicated. The advantages are: lack of hypoxia, smoother operating conditions, gagging and swallowing reflexes are not abolished, very young children react well to the technique. The only contraindication is the completely unco-operative patient.—TOM, ARTHUR (1956), *Brit. med. J.*, 1, 1085.

Penetrating Ulcer of the Tongue

This ulcer of the tongue resembles carcinoma very closely. It is a deep ulcer with a yellow slough base. It feels hard but induration does not spread into the muscle. It is painful during mastication. The cervical glands, if enlarged, are tender. Age group and distribution is the same as in carcinoma. The most obvious cause is irritation. Biopsy will determine the nature of the ulcer. The treatment of a penetrating ulcer of the tongue is removal of mechanical irritating factor, a course of parenteral penicillin and excision of ulcer by diathermy.—CASSIE, G. F. (1957), *Brit. med. J.*, 1, 325.

THE TRAINING OF DENTAL HYGIENISTS IN THE ROYAL AIR FORCE*

By Wing Commander P. A. ASKEW, B.D.S., F.D.S. R.C.S.

SHORTLY after Sir William Kelsey Fry was appointed consultant in dental surgery to the Royal Air Force he suggested the desirability of introducing the trade of dental hygienist in the service, and this proposal was put forward



Fig. 1.—Part of the clinic with the instructors' room on the right.

officially to Air Ministry by the Training Officer (Dental), Group Captain Ballantyne, in November, 1941. The idea received the active support of the Director-General of Medical Services, Sir Harold Whittingham, and after consultation with the various dental bodies, and when the necessary arrangements for training had been made, the trade was opened in January, 1943.

The Dental Training School was located at Sidmouth and the initial training of hygienists was undertaken by Squadron Leader J. W.

* One of four Casual Communications given at a meeting of the British Society of Periodontology, on Monday, January 21, 1957.

Smith and Flight Lieutenant W. L. Walker-Haworth. Follow-up supervision was carried out by Squadron Leader G. H. Leatherman at the Air Crew Receiving Centre at Regent's Park and later at R.A.F. Dental Centre, Harley Street. In 1945 the Dental Training Wing moved to R.A.F. Halton. Though the syllabus and methods of training have undergone various modifications since, the foundations so well laid in those early days still stand.

The facilities for training dental hygienists at the Dental Training Establishment consist of a dental hygiene clinic, lecture room, changing room, instructors' rest room, office, surgery, lecture room, a room equipped for showing 16-mm. sound film and slides, and the use of another lecture room when required. The clinic (Fig. 1) has chairs and equipment for 14 working places. Projecting into the clinic is an instructors' room, the walls of which are glass from 3 ft. up. The classroom is equipped with skeleton, skulls, training models, and facilities for viewing radiographs and transparencies.

The training staff consists of one specialist dental officer, one dental hygienist commissioned in the Medical Technician Branch (Dental Section), and one N.C.O. dental hygienist. The trainees are selected from three sources; first, from volunteers for the trade either on direct entry or from another trade in the service, who should possess the necessary personality and education; second, from personnel during their training as dental surgery attendants; third, from dental personnel recommended for training by their dental officer.

The aim of the training is to produce dental hygienists who are not only proficient in the practical aspect of their work but who are also keen protagonists of dental health education. To this end the theoretical and practical instruction are interrelated and wherever

possible lectures are given a clinical bias and cases are demonstrated to the trainees. However, the appreciation by the dental hygienist of clinical conditions requires a foundation in the basic sciences and these are not neglected.

The syllabus of training covers 43 weeks, of which the first 12 weeks are as for dental surgery attendants, thus giving the dental hygienist a general knowledge of service matters, particularly the administrative routine of a dental centre, dental stores, correspondence, and regulations governing dental treatment in the Royal Air Force. It gives the dental hygienist a basic knowledge of chairside work and surgery management. There may be a slight break between this part of the training and the next owing to the greater length of the second part permitting courses to be run less frequently. During this break the trainee is employed as a dental surgery attendant at a dental centre, thus gaining valuable experience in the dental surgery.

The thirteenth week is the start of the 31 weeks of dental hygienist training proper and as theoretical and practical instruction alternate, two courses are run starting at about four-month intervals. There is a senior and junior course; thus the best is made of training facilities and clinical material. Duplicated sets of notes are not widely used and the trainees write up and illustrate their own notebooks. All through these 31 weeks they write a test paper each week; this enables both trainees and instructors to keep a close eye on the progress of the course in the various subjects and, where necessary, reinforce the teaching of certain subjects.

The syllabus is planned as follows: The first 9 weeks are devoted mainly to basic subjects as the trainees must have a sound knowledge of the normal tissues and structures so as to understand the pathological conditions they will meet later. They are therefore taught general anatomy and physiology and tooth anatomy, also something of saliva and deposits on the teeth, and some anatomy of the head and neck and dental histology, so that they may appreciate the parts they will be working upon.

While they are absorbing this knowledge their practical training progresses. To improve their manual dexterity they are taught tooth carving and most manage to produce very good replicas of six or more teeth, including molars and premolars. This lasts three to four weeks, by which time they have mastered

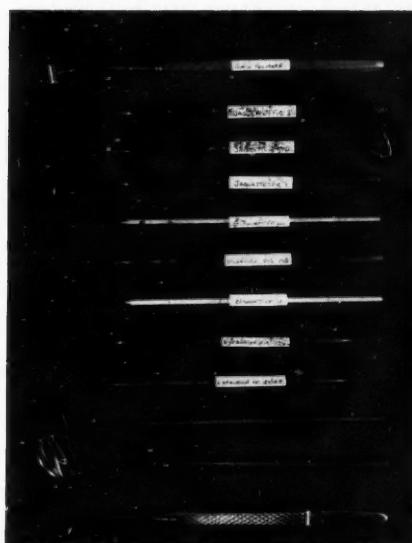


Fig. 2.—The trainee hygienist's initial armamentarium.

the use of a fine handled instrument, the Le Cron carver. The trainees are now introduced to the hygienist's initial armamentarium (*Fig. 2*), and are taught how to care for and sharpen these instruments.

The use of these instruments is taught first on a door handle (*Fig. 3*), on which are bands of hard enamel paint so that the trainees can practise the various rests, grasps, and movements by which the various scalers can be effectively and safely used. Having mastered these, the trainees progress to a dummy head. There is no substitute for the human tooth, nothing possesses the same surface, contour, and morphology, and so, the dummy heads, despite the difficulty of replacing broken teeth, are mounted with extracted teeth. These are painted with varnish and oxyphosphate

cement is applied to simulate stain and calculus. The trainees practise removing these substances and polishing the tooth surfaces with brush, rubber cup, and pumice. As the gums are also lightly varnished, any straying is only too obvious. They also learn to polish interproximally with linen strips and floss silk and pumice.

To provide experience in working through an opening, the dummy heads are swathed in a towel; other methods such as rubber or

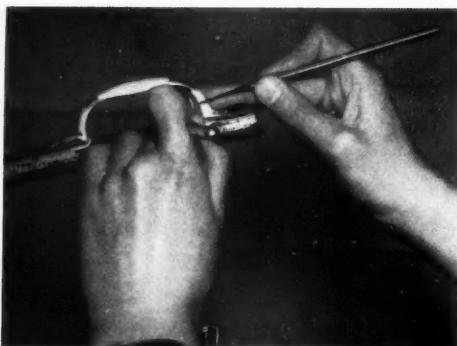


Fig. 3.—Scaling practice on the door handle.

plastic facemasks have been tried and found wanting. At this stage the trainees are taught about the toothbrush and its use; the way to instruct the patient how to use it and floss silk and wood points. They are also taught the use of the hygienator and irrigator.

At the end of this twenty-first week of training they sit an examination consisting of a written paper, practical work, and a *viva voce*. At this stage, and throughout the course, any trainee who fails to reach the required standard is withdrawn from training. The successful candidates then continue with the study of the anatomy of the head and inflammation which they had started earlier.

To these are added, as the weeks go by, bacteriology, dental caries (with particular emphasis on the aetiological factors and preventive dentistry), general dental pathology, and a little *materia medica*. In the general dental pathology particular attention is paid

to acute ulcerative gingivitis and periodontal disease.

Meanwhile they have started their clinical practice, commencing by scaling and polishing one another and then progressing from simple to more difficult cases. The procedure of scaling and polishing is subdivided and each step is checked by an instructor, the trainee using a disclosing solution before finally hand porte-polishing. The procedure is accompanied in every case by instruction of the patient in dental health, and in the use of the toothbrush and other home oral hygiene methods. At the end of about the twenty-ninth week trainees sit an examination in the subjects taken so far, consisting as before of a written paper, practical work, and an oral examination.

Having passed the interim examination the trainees have lectures on oral infection and general health, elementary radiology, diet and nutrition, and general first aid, with particular attention focusing on lectures on preventive dentistry, dentistry for children, oral hygiene, and dental health education and propaganda methods (a tape recorder is available for training the budding hygienist in group instruction). At this stage the trainees add Drury's scalers 1, 2, and 3 to their armamentarium. Their practical work now includes the treatment of children, and they also participate under close supervision in the treatment of cases of acute ulcerative gingivitis.

There is a liberal allowance of time for revision before they sit their R.A.F. Trade Test to become dental hygienists, again a three-hour paper, practical work, and a *viva voce*. Passing this examination, which is attended by examiners from the Ministry of Health, qualifies them for the Certificate of Proficiency in Oral Hygiene of the Ministry of Health.

I would like to thank Air Vice Marshal M. J. Pigott, Director of Dental Services of the Royal Air Force, for permission to publish this paper and the photographic department of the Princess Mary's Royal Air Force Hospital, Halton, for the illustrations.

A CASE OF GROSS OCCLUSAL DERANGEMENT*

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CASE REPORT

A Nigerian male University student, aged 26 years, presented on February 11, 1956, complaining of a dull constant ache in the $\overline{54}$ area, of one year's duration. This was the first time he had sought dental advice or treatment, but the $\overline{1}$ had been exfoliated about eight years previously. He was quite certain that prior to the loss of this tooth all his teeth had been in occlusal contact. His brothers and father had all their own teeth, apparently in good occlusion, and there was no medical history of any significance.



Fig. 1.—Model showing occlusion on right side.

CLINICAL EXAMINATION.—Gross occlusal derangement was apparent, particularly on the right side (*Figs. 1, 2*), but in the left posterior region the occlusion was nearly ideal (*Fig. 3*).

The form of this occlusal anomaly was particularly interesting. There was marked mesial tilting of $\overline{65}$ and a difference of 6 mm. between the occlusal levels of $\overline{5}$ and $\overline{4}$, the latter exhibiting only a slight degree of mesial tilting, whereas $\overline{11}$ were proclined excessively. Mesial tilting of $\overline{54}$ was also apparent and the gap caused by the loss of $\overline{1}$ had been greatly reduced by tilting of $\overline{21}$. An asymmetrical open bite was present, there being no occlusal contact between $\frac{65321}{643212}$, although there was contact between $\frac{4}{5}$.

Gingival recession had occurred around $\overline{54}$, and was very marked on the palatal aspect of $\overline{11}$. Pocketing was present on the distal aspect of $\overline{4}$ to a depth of 8 mm.; on the distal aspect of $\overline{6}$ to 8 mm. and mesially on $\overline{4}$ to 9 mm. but not elsewhere. The $\overline{1}$ was slightly tender to percussion and was the only tooth exhibiting any degree of mobility.

Radiographs showed bone loss in areas related to the pocketing, internal resorption of $\overline{2}$, and an area of periapical radiolucency around $\overline{2}$ (*Fig. 4*).

TREATMENT.—Occlusal harmony has been restored by means of prostheses after extraction of $\frac{654}{654212}$.

DISCUSSION

No definite conclusion was reached with regard to the deranged occlusion.

The precipitating cause would seem to have been the exfoliation of the $\overline{1}$. Loss of this tooth would normally lead to some collapse in



Fig. 2.—Model showing almost complete closure of space produced by loss of $\overline{1}$.

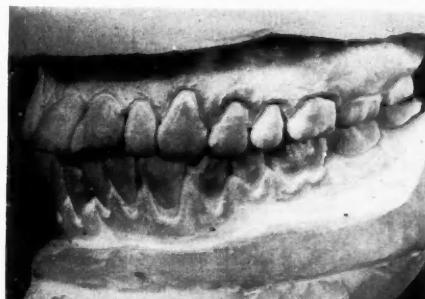


Fig. 3.—Model showing nearly ideal occlusion on the left side.

the mandibular arch followed possibly by some movement of the maxillary teeth. If this has happened in this patient, there has been a remarkable degree of mesial tilting of $\overline{65}$, while $\frac{4}{5}$ have remained almost in their

* One of four Casual Communications given at a meeting of the British Society of Periodontology, on Monday, January 21, 1957.

initial vertical axis, although they must have moved mesially to allow for the tilting of the teeth distal to them.

A contributory cause may have been the anterior tongue thrust, as the tongue was pushed between the maxillary and mandibular

the tongue thrust, might have caused the abnormal proclination of the maxillary anterior teeth.

No history of any pernicious habits or tribal practices was elicited and it would seem that these could be discounted.



Fig. 4.—Radiographs showing bone loss in areas related to pocketing, internal resorption of $\overline{2}$, and area of periapical radiolucency around $\overline{2}$.

incisor teeth when swallowing. It did not, however, appear to protrude between the posterior teeth on the affected side. His lips were rather flaccid, being typical of those found in Nigerian people, and this, combined with

Acknowledgements.—My thanks are due to Mr. A. Bryan Wade for his ever-present advice, and to the Departments of Radiology and Photography of the Royal Dental Hospital of London for their assistance.

Dental Caries during Pregnancy and Lactation

The following answer is given to the question: "During her last lactation a mother developed severe dental caries which her dentist attributed to loss of calcium in the milk. She now has another baby which she is breast-feeding. (1) Is it established that caries in pregnancy and during lactation is, in fact, simply due to the baby's competition for the mother's calcium—or are other factors at work? (2) What dietary supplements are advised during pregnancy and lactation to prevent dental caries in the ordinary case? (3) Should these supplements be increased in this case in view of the past history?"

There is good evidence that a negative calcium balance can occur during late pregnancy and the first two-thirds of the lactation cycle, but attempts by analyses to show that such a state causes demineralization of the teeth have all been unsuccessful. Most surveys of the incidence of dental caries during pregnancy do not support the hypothesis that pregnancy *per se* is a factor in causing caries. There is also no evidence to

show that caries develops more readily during lactation than at other times, but it must be admitted that no adequate survey of the problem has yet been made.

Supplementing the intake of minerals, while possibly desirable from other points of view, is therefore unlikely to have any effect in preventing caries of the mother's teeth.—*Brit. med. J.*; 1957, I, 239.

Growth at Facial Sutures

Each suture has two growth sites. Growth at a suture may or may not involve a change in position of the suture and may or may not involve separation of the bones. During early childhood the maxilla is thrust downward and forward from the anterior segment of the cranial base, but this movement is not brought about by growth in the sutures. The position of the nasion and the posterior border of the maxilla, as seen in lateral cephalograms, cannot be used as direct evidence of suture growth with separation of the bones in the analysis of growth changes in the maxilla.—SCOTT, J. H. (1956), *Amer. J. Orthodont.*, 42, 381.

A SYMPOSIUM ON CLASS II DIVISION 1 MALOCCLUSION*

I. MORPHOLOGY IN RELATION TO TREATMENT PLANNING

By Professor C. F. BALLARD, F.D.S. R.C.S., M.R.C.S., L.R.C.P., D.Orth. R.C.S.

As this is the first paper in a symposium on Class II division 1 cases, its purpose is to summarize the morphological features which produce this type of abnormality of the dento-alveolar structures and to indicate their significance in relation to treatment planning and prognosis in terms of the possibility or otherwise of producing a stable normal occlusion.

For the sake of brevity the author has had to assume that readers agree with the concept that the position of the dental arches, normal or abnormal, are the result of soft-tissue morphology, patterns of motor activity of the soft tissues, and skeletal morphology; that clinical experience has now proved that in treatment the skeletal morphology cannot be changed by orthodontic treatment; and that soft-tissue morphology and its behaviour are only adaptable in certain limited ways, to be discussed in this paper.

These concepts infer that it can no longer be accepted that postnatal environmental factors play an important part in the production of malocclusions. It will be argued later that thumb-sucking is not an important cause of malocclusion and the author states dogmatically that those who believe that early loss of deciduous teeth can produce Class II division 1 and Class III malocclusions are blind to the morphological features always associated with these malocclusions. Early loss of teeth, however, may complicate treatment out of all proportion to the original condition.

A cephalometric analysis of 105 cases of Class II division 1 out of retention has confirmed that statements which have been made previously, based on clinical experience, are correct. It was hoped to relate statistically

the stable changes that had occurred to the clinical analysis of soft-tissue morphology; however, this was found to be impossible because over the last five years descriptions of lip morphology and tongue behaviour, etc., had changed a little and become more definite. Some of the facts that are evident from this analysis will be mentioned later, but it must be stated now that there was no evidence that treatment had changed the dental base relationship, or that it had changed even as a result of normal growth during the period covered by the lateral radiographs. In five cases evidence to the contrary could have been produced, but only if the fact that habitual positions of the mandible as distinct from the endogenous position do occur and should be found in the clinical examination. This will be discussed later.

Class II division 1 malocclusions are the result of a combination of morphological features, mainly inherited, which can be discussed under the following headings: (1) Skeletal (dental base relationship); (2) Soft-tissue morphology; (3) Patterns of motor activity of the soft tissues; (4) Local factors within the dento-alveolar structures.

Again for the sake of brevity, it is necessary to tabulate the factors and then briefly define them where necessary.

Class II Division 1 Morphology. Classifying the Malocclusion on the Basis of Labial Segment Relationship rather than Molar Relationship.—

1. *With a Class I Dental Base Relationship.—*
 - a. Incompetent lip morphology.
 - b. Atypical swallowing behaviour.
 - c. Incompetent lip morphology and atypical swallowing behaviour.
 - d. Other variations of orofacial morphology or behaviour (may be associated with a and b).

* Read at the Newcastle upon Tyne meeting of the British Society for the Study of Orthodontics, May 12, 1956.

2. With a Class II Dental Base Relationship.—

- Competent lip morphology.
- Incompetent lip morphology.
- Atypical swallowing behaviour.
- b and c together.
- Other variations of orofacial morphology and behaviour.

Sub-division: Mandibular labial segment proclined in soft-tissue balance to completely

In planning treatment it is important to realize that the buccal segments in contact with the labial segment contribute to its stability in the proclined position. In other words, in an intact arch with all teeth in contact, the buccal segments must be recognized as a factor, with the tongue, in balancing lip activity. From clinical experience supported by cephalometric analysis one is inclined to say that this factor in the lower arch is the

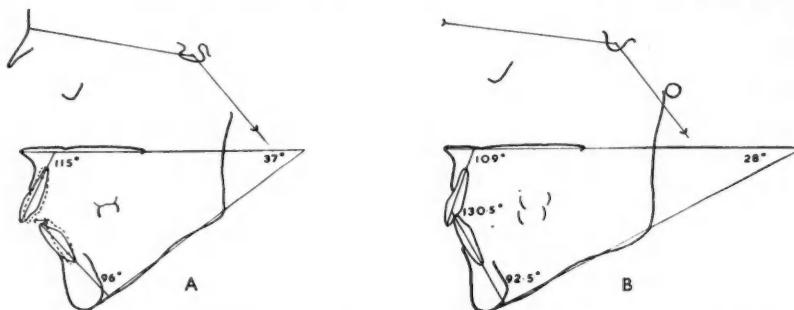


Fig. 1.—A, A tracing constructed around the mean values of 250 random selected individuals. B, Shows the method of correcting axial inclinations of upper and lower labial segments to the mean values to demonstrate the dental base relationship. N.B.— $\frac{1}{1}$ to mandibular plane angle varies inversely as the maxillary-mandibular plane angle (Ballard, 1951).

or partially compensate for the postnormality of dental base relationship.

From long clinical experience the author believes that the best method of assessing dental base relationship is that which originated at the Royal Dental Hospital ten or more years ago (Ballard, 1948, 1953). It is suggested, however, as a result of cephalometric analysis of a large number of cases that it is better to use the maxillary plane instead of the Frankfort. The mean values of 250 unselected individuals are given in Fig. 1 A, and Fig. 1 B shows the use of these as previously described to assess the degree of postnormality of the mandibular base in relation to the maxillary base.

The primary feature of treatment of any Class II division 1 malocclusion on a Class II dental base is to have the lower labial segment as much labially proclined as soft-tissue posture and behaviour will permit to remain stable, compensating as far as is possible for the postnormality in the skeletal morphology (Ballard and Walther, 1953).

equivalent of about 4° of labial inclination. It is a finite amount and the oft-repeated statement that the farther back the extraction the less the collapse, cannot be supported by clinical and cephalometric analysis. Extractions back to and including the first permanent molars will result in a definite amount of lingual collapse comparable to the amount that the buccal segment or segments contributed to the stability of the labial segment.

The essential factors within the dento-alveolar structures, therefore, excluding the complication of early loss of deciduous teeth are the relationship of the buccal segments to the Class II division 1 position of the labial segments and the way in which their position contributes to the abnormality.

In both arches the buccal segment can be:—

- In contact with the labial segment.
- Forward of the labial segment producing overlap of canines over laterals and incisor crowding—anteroposterior crowding.
- Spaced from the labial segment.

Now to go back and discuss briefly how these various morphological features contribute to the aetiology of the malocclusion and influence treatment and prognosis:—

Incompetent lip morphology has been discussed before, but has never been clearly defined and for diagnostic purposes it is important to do so. First, however, competent lip morphology must be defined. It is as follows:—

With the mandible in its endogenous postural position (physiological resting posture, Thompson, 1949), and the muscles of facial expression in resting posture, the lips are in contact maintaining an anterior oral seal. The endogenous posture of the mandible and of the facial muscles can be shown electromyographically as the position of electrical silence when the individual is standing or sitting upright unsupported (Tulley, 1953; Perry, 1955; Shpuntoff and Shpuntoff, 1956).

Incompetent lip morphology is a failure of the lips to produce an anterior oral seal when the mandible is in its endogenous postural position and the muscles of facial expression are similarly in "resting" position. The significance of incompetent lip morphology is that to produce an anterior oral seal there has to be circumoral contraction, and as a general rule the mentalis muscle and the orbicularis oris muscle in the lower lip are more active than the orbicularis oris muscle in the upper lip.

With incompetent lips on a Class I dental base relationship, a Class II division 1 labial segment relationship can be produced by the combination of two factors:—

1. The contraction of the mentalis and orbicularis oris muscles maintaining the lower labial segment in a more lingually inclined position than would otherwise be the case.

2. The open lip posture not maintaining an adequate restraining influence on the upper labial segment when there is anteroposterior crowding in the maxillary arch, the tendency for the buccal segments to move forward increasing the factor of the support of the buccal segment to the labial segment and producing some degree of proclination.

Evidence of the latter factor comes from the fact that in such cases removal of 4/4

frequently results in complete reduction of the overbite by the dropping back of the upper labial segment without any active treatment.

It is important to realize that, except in very mild degrees of incompetence associated with a bimaxillary proclination which has been reduced a little by treatment, incompetent lip morphology cannot by exercising or conscious effort become a competent lip morphology; although, according to the degree of incompetence an anterior oral seal may be maintained by contraction of the circumoral musculature either subconsciously or by conscious effort before or after orthodontic treatment. It is also necessary to appreciate that in extreme degrees of incompetent lip morphology no effort should be made to maintain a lip seal as a habitual posture, the necessary circumoral effort spoiling the appearance of the individual. On a Class II dental base relationship, the significance of the contraction of the musculature of the lower lip is that, except in very mild cases, any treatment which proclines the lower labial segment, although theoretically right from the point of view of compensating for the postnormality of the dental base, will inevitably relapse.

As was discussed last year it is now fairly certain that in diagnosis we must distinguish between the endogenous tongue-thrusting behaviour and that which is a habit activity (Ballard, 1955). The latter arises as part of the pattern of activity to produce an anterior oral seal when the labial segment relationship is abnormal as in Class II division 1 and Class II division 2. If the treatment produces a normal labial segment relationship the habit activity disappears. Since last year the author has found that Fieux (1953) was probably the first to suggest that some atypical swallowing behaviours were habits only.

The endogenous type of tongue thrust was probably first noticed by Froeschels (1937), who found that sigmatism was due to tongue position and activity and not due to malocclusion. He said protrusion of tongue between teeth was performed with undue effort. In 100 cases examined he found that in only 6 of them was the anterior open bite sufficient

to permit a protrusion of the tongue without an opening of the jaws. The severity of the sigmatism when present in these cases appears to be directly related to the degree of abnormality of the dento-alveolar structures and hence to the degree that the thrusting behaviour

stated above. If, on the other hand, other morphological features such as incompetent lips or a Class II dental base relationship are present, then the tongue thrust will contribute to the Class II division 1 labial segment position. Theoretically, therefore, treatment

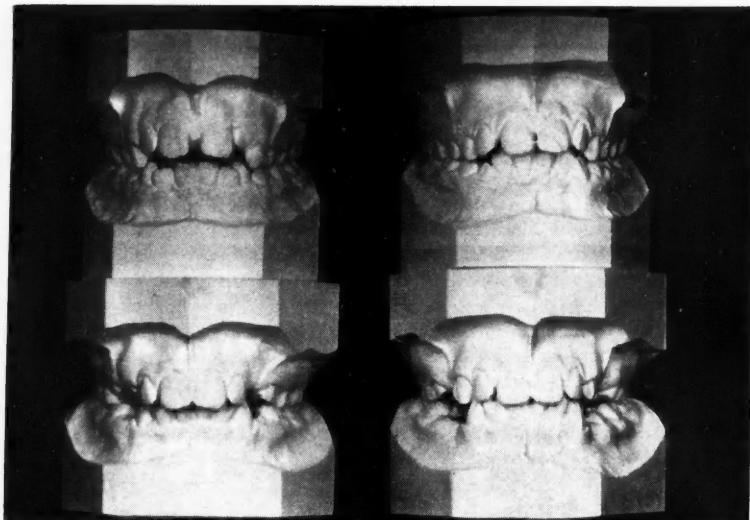


Fig. 2.—Serial models showing slow reduction of an open bite without treatment in a tongue-thrusting case.

is abnormal. In most cases there is spontaneous disappearance of the speech defect by about 10–11 years of age. In such cases there is also improvement in the labial segment relationship without treatment if other factors permit (*Fig. 2*). In a few cases the sigmatism is controlled after training by a speech therapist and there is a small percentage of individuals who cannot control the tongue sufficiently to eliminate the sigmatism however much conscious effort they apply. In all these cases the tongue behaviour does not change as far as can be seen clinically.

From clinical observation the author now believes that the endogenous tongue-thrusting behaviour does not produce a Class II division 1 labial segment relationship. If the other morphological features would produce a Class I labial segment relationship then the abnormality produced is either an open bite, or if less severe, a slowly improving open bite as

should be planned in relation to the other morphological features and the tongue-thrusting ignored. Many will disagree with this, but so far the stable results achieved over the last five years support this approach.

Under variations of expressive behaviour the most important is that which consists of a firm retraction of the lower lip during expressive behaviour and speech (Ballard, 1953). This retraction appears to come from the modioli and orbicularis oris; it is not a contraction of the mentalis muscle. The upper lip in such cases does not retract, but frequently everts or pouts a little in expressive behaviour. In such cases the dental base relationship is usually slightly postnormal, with a well-developed mental eminence. The lips are competent. The lower labial segment is usually lingually inclined and in no case has a proclination remained stable. It is aesthetically unsatisfactory to retract the upper labial

segment back to the lower in such cases. The increased overjet, therefore, must only be reduced and not completely eliminated. This pattern of activity is frequently a family characteristic, which supports the view that patterns of activity are inherited.

Finally, there is a combination of competent lip morphology on a Class II dental base relationship in which the lower lip is lingual to the upper incisor teeth. In such cases the increased overjet may or may not be associated with a proclined upper labial segment, although lip tongue balance in relation to the lower labial segment has not produced a relatively proclined position to compensate for the Class II dental base relationship. The significance of the combination of competent lip morphology on a Class II dental base relationship is that the lower labial segment can be proclined to compensate either completely or partially for the postnormality of dental base relationship. This means, in fact, that the whole of the lower arch can be brought forward. With this type of case it would appear that as much as 10° of change of axial inclination labially of the lower labial segment will remain stable.

This type of case is frequently said to be due to lower lip sucking. It is, however, the Class II dental base relationship which is the primary fault and it is doubtful whether there is any true lip-sucking behaviour involved. Cases illustrating this type were shown by Ballard and Walther (1953).

Having determined from the study of morphology and behaviour where upper and lower labial segments will remain stable at the end of treatment, it is necessary to assess what adjustment of the buccal segments is required in relation to the proposed change of labial segments. Either the buccal segments can be moved anteroposteriorly or extraction may be required.

First, to deal with the maxillary arch. If the labial segment is proclined, and the buccal segment is in contact with it, then during treatment either the buccal segment must be moved distally or retraction of the labial segment must follow the removal of a unit in the anterior part of the buccal segments.

Distal movement of buccal segments is only possible: (a) if the dental base is long and there is potentially space posteriorly; (b) there is adequate anchorage either in the mandible or extra-orally. Distal movement can be assisted by removal of second permanent molars in suitable cases. In such cases the same amount of anchorage is not required.

When the buccal segments are forward of the labial segments, whether or not it is proclined, then, as a general rule, this indicates that the arches are short anteroposteriorly and extractions in the anterior part of the arch are indicated. However, occasionally distal movement of buccal segments with or without extraction of $7/7$ is satisfactory when there is about half a unit bilaterally of antero-posterior crowding. Spacing in the maxillary arch in a Class II division 1 malocclusion frequently means that treatment is very simple, no extractions are required and only slight distal movement of first permanent molars is necessary and easily accomplished.

In the mandibular arch the whole treatment plan revolves round three factors:—

a. Whether soft-tissue morphology and behaviour would permit the forward movement of the lower arch with a proclination of the labial segment.

b. Whether there is anteroposterior crowding in the lower arch.

c. How much anchorage is required in the lower arch for treatment of the maxillary arch. If the lower labial segment can be proclined, then the lower arch can be used for anchorage until it has been decided that the lower labial segment has been proclined the amount that the soft tissues will permit. If, at this stage, sufficient distal movement of the maxillary teeth has not been achieved, then the possibilities are either to use some extra-oral anchorage or, alternatively, to extract, and if the case has been planned correctly, it would at this stage be second permanent molars. If there is anteroposterior crowding in the mandibular arch and the lower labial segment can be proclined, then the treatment is antero-posterior expansion in the mandibular arch without using it for Class II traction. In other words, find the space for the crowded canines

by proclining the labial segments, leaving the buccal segments where they are. If there is anteroposterior crowding in the mandibular arch and the lower labial segment must not

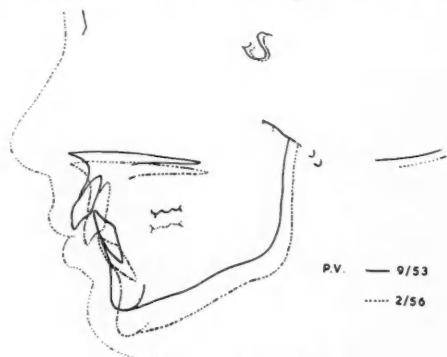


Fig. 3.—Superimposed tracings before and after treatment demonstrating bodily retraction of upper incisor teeth.

be proclined, then, as a general rule, treatment is the removal of a unit bilaterally, usually the first premolars, and the use of some Class II traction to close up residual spaces so that there is no risk of the lower labial segment collapsing lingually. If there is spacing in the mandibular arch, then the buccal segments can be used for Class II traction until the spaces have been closed, thereafter only continuing with traction if some proclining of the labial segment is permissible.

Finally, it should be said that the mandibular arch can be used for light Class II traction, even if it must not be brought forward, if adequate anchorage to the whole arch is established. This can be done with a removable appliance and a labial bow.

Brief mention should be made of the fact that in previous papers the author has said that on a Class II dental base relationship with incompetent lip morphology the end-result is frequently poor (Ballard, 1953), because the upper labial segment has to be lingually inclined in the stable end-result. There is some hope of achieving a less unsatisfactory end-result if a technique is used which produces some palatal movement of the apices of the upper incisors as their crowns are retracted (*Fig. 3*) (Holdaway, 1956).

However, there is a limit to this type of tooth movement, and undoubtedly many of the extreme degrees of Class II dental base relationship that are seen in this country will not be greatly benefited by such a tooth movement. The width of the dental base may not be the only limiting factor, but the relationship of the incisal tip to lower lip may be important for stability, a lingual inclination of the upper incisors with their incisal tip inside the lower lip being in some cases essential.

Mention must be made of habit activities in relation to Class II division 1 malocclusions. First, those associated with mandibular posture. As has been previously stated, many individuals with a Class II division 1 type of overjet posture forward habitually in order to assist in the maintenance of an anterior oral seal. This habit position is downwards and forwards from the endogenous postural position (physiological rest position). If it is mistaken for and cephalometrically recorded as the endogenous postural position, then the cephalometric analysis of before and after positions of the mandible would seem to indicate that the mandible is farther back at the end of treatment (Ricketts, 1952).

The author would also suggest that it is this habitual position of the mandible which caused Moyers to find abnormal patterns of activity of the muscles in Class II division 1 cases. This habit activity, of course, disappears when the increased overjet has been eliminated by treatment. It is also important to realize that this habit postural position is almost invariably associated with a tip of tongue to lower lip contact in the production of an anterior oral seal. When this is so, there is a habit activity of tongue-thrusting which has been previously mentioned in this paper, and was discussed in greater detail last year (Ballard, 1955). This type of habit activity is not only present in Class II division 1 cases before treatment, but it can also be induced in a certain type of case as the result of treatment. The author is convinced that many cases reported as excellent results of Class II division 1 malocclusion only appeared so good because they were the types in which the treatment induced the forward posturing. If in such cases they are

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asked to bite for the purpose of recording occlusion cephalometrically, they almost invariably close in the forward position, giving a false mandible-to-maxilla relationship. On cephalometric analysis it would appear that the mandible has been made to grow forward.

amount, the habit changes its pattern, the overjet is partially eliminated by a downward and forward posturing of the mandible until the tip of the tongue contacts the lower lip between the upper and lower labial segments. During mastication the mandible goes back

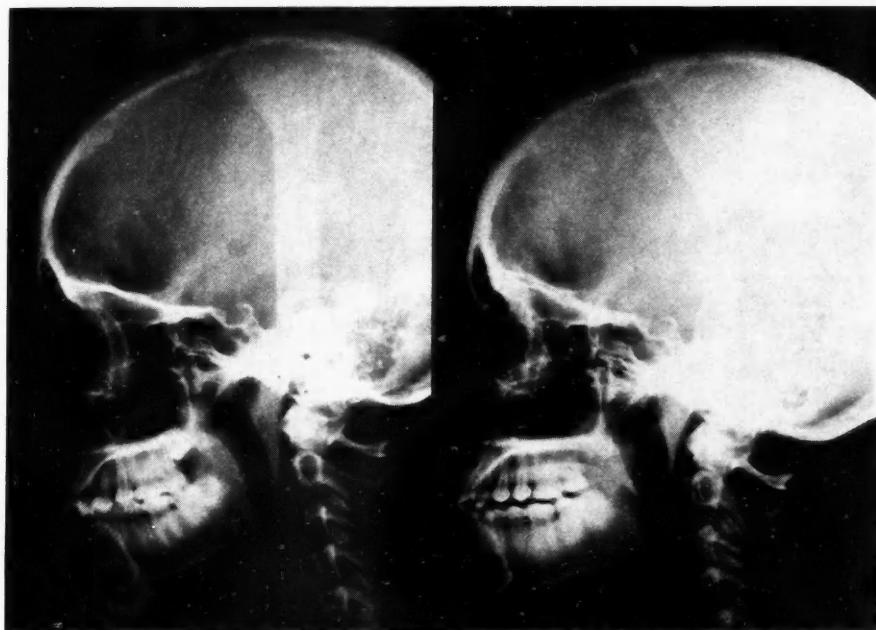


Fig. 4.—Shows the lateral radiograph in occlusion before treatment and lateral radiograph in the forward posturing after treatment.

From an analysis of the cases which have been recorded at the Eastman which show habit posturing at the end of treatment, it is possible to state that the usual morphological features are as follows:—

1. A Class II dental base relationship associated with an average or below average maxillary-mandibular plane angle.

2. A competent lip morphology.

3. The upper incisors resting either into or just in front of the lower lip, but being almost completely covered by the upper lip.

Before treatment an anterior oral seal is produced with considerable contact of the tongue against the lower lip; after the treatment has reduced the overjet only a small

to its centric position. This is not a true displacing activity. *Figs. 4, 5* illustrate such a case.

It only remains to mention the habit of finger- and thumb-sucking. The author realizes that it is, at this stage, quite impossible for him to prove his statement, but he is convinced that clinical and cephalometric observation of the position of the dento-alveolar structures in relation to the morphological features that have been discussed both before and after treatment, and in relation to the relapses that have followed attempts to treat, leave no doubt whatsoever that finger- and thumb-sucking is only very rarely the cause of a Class II division 1 labial segment relationship. The

habit of finger- and thumb-sucking, in fact, will only contribute to a Class II division 1 labial segment relationship if the other morphological features will produce such relationship

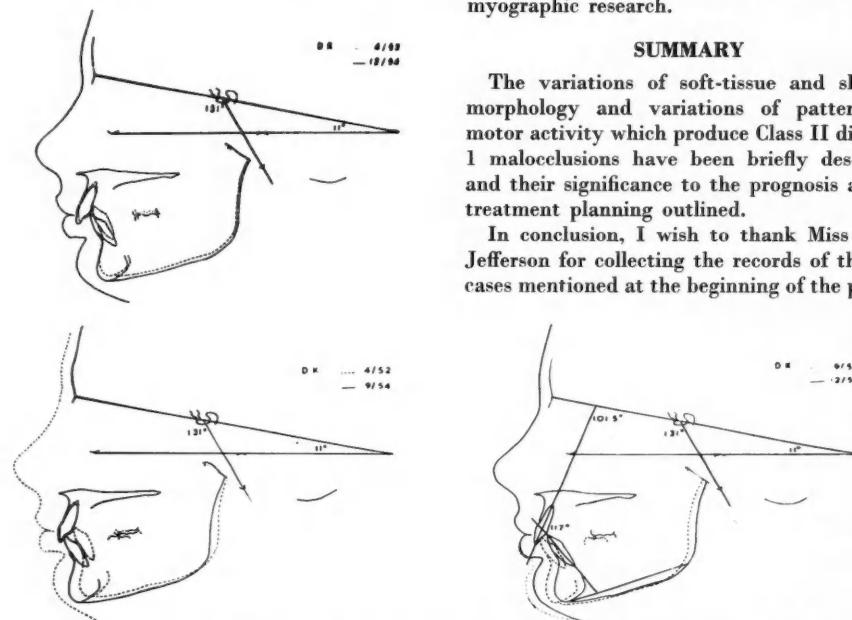


Fig. 5.—Same case as Fig. 4. Superimposed tracings in centric and forward posturing positions before and after treatment.

without the habit. The majority of Class II division 1 cases which present to an Orthodontic Clinic give no history whatsoever of finger- and thumb-sucking. On the other hand a large number of Class I dental base relationship cases, Class II division 2, and Class III labial segment relationship cases give a history of persistent thumb-sucking and by no stretch of imagination could the habit have contributed to the occlusal abnormality.

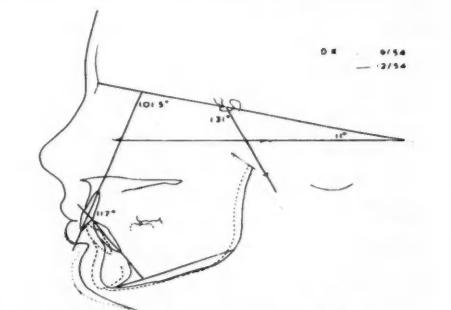
Finally, it must be said that the paper is an abbreviated version of that presented to the Newcastle Meeting, and references to the works of authors whose observations have contributed to the conclusion reached have had in the main to be omitted. As far as orofacial behaviour is concerned the most important are Rix, Gwynne-Evans, Tulley, and Hovell, and as far as mandibular posture and movement

are concerned the original work was done by Thompson, and a considerable number of men have contributed to our knowledge both by clinical observation and electromyographic research.

SUMMARY

The variations of soft-tissue and skeletal morphology and variations of patterns of motor activity which produce Class II division 1 malocclusions have been briefly described and their significance to the prognosis and in treatment planning outlined.

In conclusion, I wish to thank Miss C. C. Jefferson for collecting the records of the 105 cases mentioned at the beginning of the paper;



and Mr. Morgan, of the Photographic Department of the Institute of Dental Surgery, for the illustrations.

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II. TREATMENT

By W. H. LITTLEFIELD, B.D.S., H.D.D. R.C.S., D.Orth. R.C.S.

STRICTLY speaking, of course, the term Class II division 1 malocclusion should be reserved for that type of malocclusion where the mandibular arch is distally related to the maxillary arch by half the width of the first permanent molar, or the entire width of a premolar, and where the maxillary incisors are in labioversion. In practice, however, many malocclusions are encountered where there are definite signs of Class II division 1 malocclusion but where the mandibular arch is distally related to the maxillary arch by an amount which is less than the entire width of a premolar. For example, in some cases, the mandibular arch is only half a premolar width distal to the maxillary arch and the lower teeth occlude cusp to cusp with the upper teeth. These, what one might term tendencies to Class II division 1 malocclusion, are frequently seen and often require treatment. It is felt, therefore, that they should be included in this paper.

The purpose of this paper is to consider the treatment of Class II division 1 malocclusion. In practice, however, before treatment is commenced a number of factors must be considered. Consequently the subject will be dealt with under two main headings:—

1. Factors to be considered before treatment is planned.
2. Principles of treatment with examples of treated cases.

FACTORS TO BE CONSIDERED BEFORE TREATMENT IS PLANNED

It is of course always necessary to consider all such factors as the patient's age, circumstances with regard to schooling, travelling, and possible co-operation, the patient's health, the teeth themselves with regard to caries, pathology, malformation, and absence, and the condition of the periodontal tissues. In addition the following should also be considered:—

Relationship of Size of Teeth to Size of Bone.—The relationship of the size of the teeth to the size of the bone needs to be assessed, the degree of spacing or crowding being noted. As a general rule, where the teeth are spaced,

no extractions are indicated and, where there is slight crowding, it may only be necessary to extract teeth from the upper arch. However, where severe crowding is present, one is often obliged to extract teeth from the lower arch and these lower extractions frequently decide which upper teeth must be removed.

Cause of the Labial Segment Relationship.—The cause of the abnormal labial segment relationship seen in Class II division 1 malocclusion must always be carefully studied. Much of course has been written on this subject, but a simple view would seem to be that there are two major factors which cause the increased overjet seen in Class II division 1 malocclusion. These are the skeletal pattern (i.e., the relationship of the lower apical base to the upper apical base) and tilting of the upper and lower labial segments on their respective apical bases.

1. *Skeletal Pattern.*—Where the lower apical base is posteriorly related to the upper apical base there is obviously a tendency for the lower incisors to be posterior to the upper incisors and, in practice, a number of cases of Class II division 1 malocclusion are seen where the apical base relationship appears to be the sole cause of the increased overjet.

2. *Tilting of the Labial Segments.*—The upper and lower labial segments become tilted on their apical bases owing to the position and action of the lips and tongue and also owing to habits. Commonly the upper incisors are proclined and more rarely the lower incisors are retroclined. Consequently, cases of Class II division 1 malocclusion are seen where the apical bases are normally related and the sole cause of the abnormal labial segment relationship is tilting of the labial segments.

However, in practice, many cases are found where these two major factors are mixed. In some the main cause is the skeletal pattern, whilst in others it is tilting of the labial segments.

Therefore, when considering the cause of the labial segment relationship of a Class II division 1 malocclusion, the skeletal pattern

should be carefully assessed. Now the consensus of opinion seems to be that, with the appliances in general use, it is not possible to alter the skeletal pattern, and my own experience is that, at any rate, it is better to work on the assumption that it will not be altered. Therefore, in the first type of case, where the skeletal pattern is the sole cause of the excessive overjet, a normal incisor relationship can only be achieved by proclining the lower incisors and retroclining the upper incisors. As a general rule, it is better not to do this, partly because the result frequently relapses, but mainly because the final appearance of the retroclined upper incisors is usually worse than the original condition.

In the second type of case, where the skeletal pattern is normal and the excessive overjet is caused by tilting of the labial segments, the musculature, both at rest and in action, should be examined and any abnormal sucking habits investigated. As a general rule, the lower incisors are rarely retroclined except by the mechanical action of a habit and only in these habit cases can the lower incisors be safely proclined without the risk of relapse. Then, with regard to the upper incisors, the most important decision to make is whether, if they are retroclined to a normal relationship to the upper apical base, they will come under the influence of the lower lip and be retained by it, despite any forward action of the tongue.

In the third type of case, which is commonly seen in practice, the causes are mixed. The lower apical base tends to be posteriorly related to the upper apical base and, in addition, the labial segments are tilted on their apical bases owing to the musculature or habits. It is difficult to be dogmatic about the treatment of these cases but, in practice, the following seems to be true:—

1. As a general rule, it is not possible to maintain an incisor relationship better than the skeletal pattern warrants. In other words, when the case has been completed and all retention has ceased, the incisor overjet and overbite usually remain excessive and reflect the postnormality of the skeletal pattern.

2. Again as a general rule, the lower incisors should not be proclined, unless they have been

previously retroclined by the mechanical action of a habit. Otherwise they tend to relapse.

3. With regard to the upper incisors, the main thing to decide is whether, if they are retroclined to an average relationship to the upper apical base, they will come under the influence of the lower lip and be retained by it, despite any forward action of the tongue.

Retroclination of the Upper Labial Segment.

—If it is decided that the upper labial segment can be retroclined and retained in a retroclined position, there are then two things to consider:—

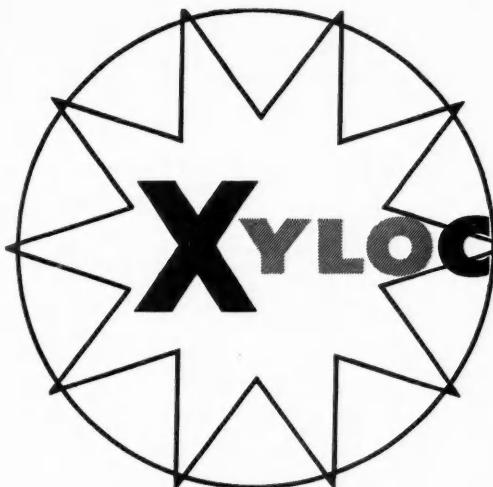
1. *Incisor Overbite.*—The amount of the incisor overbite should be investigated. It may or may not be excessive and this may decide whether or not a bite plane will be required in the treatment.

2. *Extraction of Upper Teeth.*—It must be considered which upper teeth, if any, should be extracted in order to allow the upper labial segment to be retroclined. When making this decision, in addition to considering all the factors mentioned previously, one should also assess the severity of the Class II division 1 malocclusion and decide how much space is required in order that the upper incisors can be retroclined. In general, the severer types of Class II division 1 malocclusion require more space and one tends to extract more anteriorly. The less severe types require less space and one tends to extract more posteriorly in order to avoid spaces remaining in the anterior part of the mouth.

PRINCIPLES OF TREATMENT

After all the above factors have been carefully considered, then, and only then, is it possible to plan the treatment of a Class II division 1 malocclusion, and in practice the following principles have been found to be useful:—

Preservation of Tooth Tissue.—Whenever it is recognized that a case of Class II division 1 malocclusion will require treatment by appliances every effort is made to preserve the tooth tissue. It is particularly important to preserve the lower teeth. Early loss of lower deciduous teeth often results in collapse of



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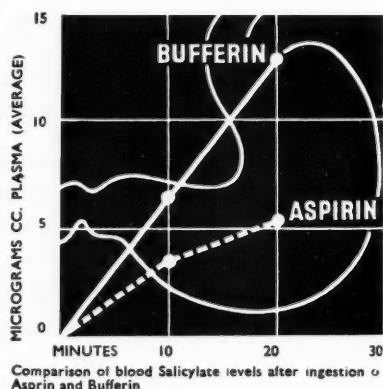
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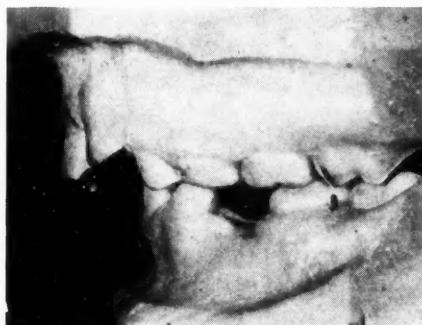
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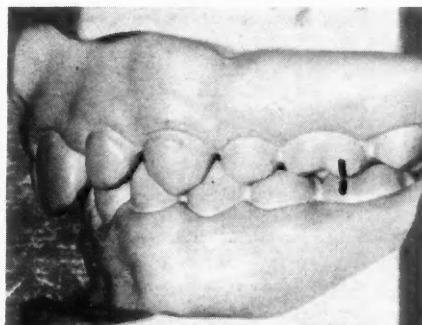
the lower arch, which complicates treatment, whilst loss of lower permanent teeth sometimes renders orthodontic treatment impossible.

Maintenance of Spaces.—In spite of all conservative efforts deciduous teeth are lost. When this occurs the spaces are watched and, if they show signs of closing, space maintainers

Treatment in the Deciduous Dentition.—As a general rule, it is found that effective and comprehensive treatment of a Class II division 1 malocclusion in the deciduous dentition is not possible. The measures mentioned previously, with regard to the preservation of tooth tissue, maintenance of spaces, opening of lower spaces, and cessation of sucking



A



B

Fig. 1.—A, Class II division 1 in mixed dentition with early loss of $\overline{1\bar{1}}$. B, Result after treatment by arch and removable appliance to retrocline $\underline{2\bar{1}\bar{2}}$, followed by extraction of $\underline{4|4}$.

are fitted. Again, special attention is paid to lower spaces in order to prevent collapse of the lower arch.

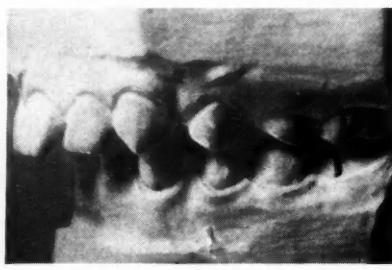
Opening of Lower Spaces.—However, many cases of Class II division 1 malocclusion are seen where lower spaces have closed. Under these circumstances it is usually necessary to open the lower spaces, unless their closure is great enough to be a sign of severe crowding requiring extraction of teeth from the lower arch.

Cessation of Sucking Habits.—There seems to be some difference of opinion about the importance of thumb- and finger-sucking as causes of malocclusion and there is some doubt whether they play a part in the aetiology of Class II division 1 malocclusion. However, there can be no argument that these habits should be stopped before any attempt is made to retrocline upper incisors. There is little to be gained in trying to retrocline upper incisors when, at the same time, the child is attempting to procline them by a thumb- or finger-sucking habit.

habits, are of course instituted. Apart from these, some improvement may be obtained if the child is provided with an oral screen, constructed to press on his upper incisors.

Treatment in the Mixed Dentition.—When the mixed dentition stage is reached effective treatment of a Class II division 1 malocclusion is often possible. However, it is necessary to discuss whether treatment at this stage is indeed wise. On the one hand, it is very rightly pointed out that, after the incisor relationship has been corrected, a long period of retention over a number of years is usually required. Consequently, some authorities argue against the treatment of Class II division 1 malocclusion in the mixed dentition stage, preferring to wait until the permanent dentition is established. On the other hand, however, it must be emphasized that, because of the proclination of the upper labial segment, Class II division 1 malocclusion is a common predisposing factor in the fracture of upper incisors. Consequently, when treatment is delayed until the permanent dentition stage

has been reached, there is more risk to the upper incisors. On balance, it is surely better to face a long retention period than be obliged to treat a Class II division 1 malocclusion with the complication of fractured upper incisors. Therefore, whenever possible, treatment of Class II division 1 malocclusion is started in the mixed dentition stage.



A

Fig. 2.—A, Tendency to Class II division 1 with spacing of teeth. B, Result after treatment by intermaxillary traction, using fixed appliances. No teeth were extracted.

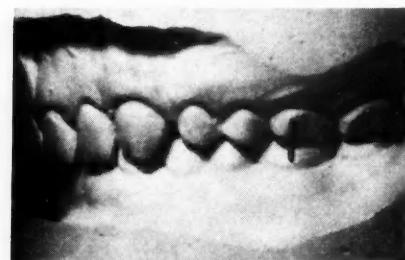
In practice, it is usually found best to carry out serial extraction in the upper arch with retroclination of the upper incisors. First, the upper deciduous canines are extracted and, if necessary, a bite plane is fitted. Following this, the upper incisors are retroclined and, at a later date, it is often found necessary to extract the upper first premolars. Subsequently, of course, a long retention is usually required. Fig. 1 A, for example, shows models of a Class II division 1 malocclusion in the mixed dentition stage. There was a history of thumb-sucking, which had ceased, and there had been early loss of \overline{D} . The lower arch was maintained by means of a lower space maintainer. Serial extraction in the upper arch was carried out and the upper incisors were retroclined by means of a removable appliance. Later, $4\frac{1}{2}$ were extracted and a long retention was necessary, using an oral screen. The result is shown in Fig. 1 B.

Treatment in the Permanent Dentition.—Treatment of Class II division 1 malocclusion in the permanent dentition may or may not involve the extraction of teeth and can be considered under the following headings:—

1. *Without Extractions.*—Treatment without extractions is usually indicated when the

teeth are spaced. Fig. 2 A shows an example of a tendency to Class II division 1 malocclusion, with spacing of the teeth. Treatment was by means of intermaxillary traction, using fixed appliances, and no teeth were extracted. The result is shown in Fig. 2 B.

2. *Extraction of Upper Teeth.*—Many cases of Class II division 1 malocclusion require



B

extraction of permanent teeth from the upper arch, in order that the upper labial segment may be retroclined. Any of the upper teeth may, of course, be selected for extraction, but the following principles are suggested:—

a. *Central incisors:* Upper central incisors are seldom extracted. Sometimes, however, they are badly fractured and must be removed and sometimes, of course, they are lost as a result of trauma. Under these circumstances, if there is crowding in the upper incisor region, a central incisor space may be utilized in order to retrocline the remaining incisors.

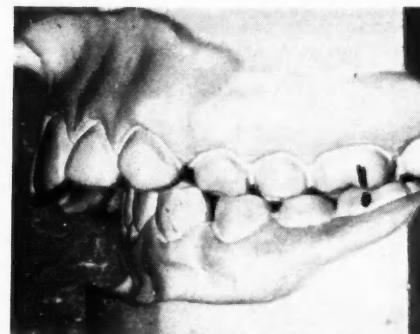
b. *Lateral incisors:* Extraction of upper lateral incisors is seldom indicated but, if they are absent, the spaces are, of course, utilized. Occasionally, however, when they are malformed or badly misplaced, they are extracted and the remaining upper incisors are retroclined.

c. *Canines:* Again, of course, when upper canines are absent, the spaces are utilized in order to retrocline the upper incisors. The only indications for extraction are when they are badly misplaced or severely rotated.

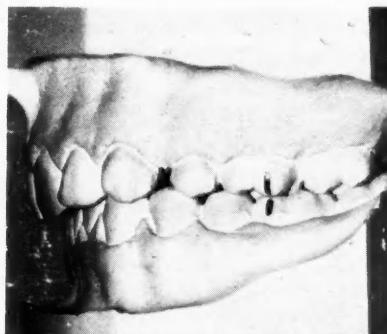
d. *First premolars:* The upper first premolars are probably the most popular teeth to

be selected for extraction in the treatment of Class II division 1 malocclusion. Nevertheless, it is well to realize that their extraction provides rather large spaces for the retroclination of the upper labial segment and should, therefore, be reserved for the treatment of severer types of Class II division 1 malocclusion. For

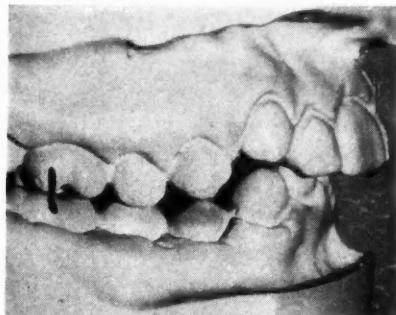
e. Second premolars: When upper second premolars are absent their spaces are utilized in treatment and extraction of upper second premolars is indicated when they are badly misplaced palatally. Otherwise their extraction is usually restricted to the milder types of Class II division 1 malocclusion, where less



A



B



C



D

Fig. 3.—A, Severe Class II division 1 with large incisor overjet and lower arch a full premolar width distal to upper arch. B, Result after extraction of $\frac{4}{4}$ and treatment by intermaxillary traction, using fixed appliances. C, Tendency to Class II division 1 with lower arch only half a premolar width distal to upper arch. D, Result after extraction of $\underline{5}\underline{5}$ and treatment by removable appliances to move $\frac{4}{4}$ distally and retrocline $\underline{3}\underline{2}\underline{1}\underline{2}\underline{3}$.

example, Fig. 3 A shows a severe type of Class II division 1 malocclusion. There was a large incisor overjet and the lower arch was distal to the upper arch to the extent of the full width of a premolar. The case was treated by extraction of $\frac{4}{4}$ followed by intermaxillary traction, using fixed appliances, and the result obtained is shown in Fig. 3 B. Small spaces remained distal to $\underline{3}\underline{3}$, but these are, of course, a common occurrence after the extraction of $\frac{4}{4}$.

space is required for the retroclination of the upper labial segment. Fig. 3 C shows an example of such a condition. There was a tendency to Class II division 1 malocclusion and if $\frac{4}{4}$ had been extracted, it would have been necessary to move $\underline{6}\underline{5}\underline{5}\underline{6}$ mesially as well as $\underline{3}\underline{2}\underline{1}\underline{2}\underline{3}$ distally. Therefore, in this case, $\underline{5}\underline{5}$ were extracted. Following this, $\frac{4}{4}$ were moved distally and the upper incisors retroclined, all by means of removable appliances.

The result which was obtained is shown in Fig. 3 D.

f. First molars: Upper first molars are, of course, extracted when they are very carious, but it is better if their extraction can be restricted to the milder types of Class II division 1 malocclusion. If they are extracted in a severe Class II division 1 case, one is

It is interesting to note the good contact point relationship between 7 and 5.

g. Second molars: Extraction of upper second molars is indicated in milder types of Class II division 1 malocclusion, but is usually reserved for those cases where upper third molars are present. For example, Fig. 4 C shows models of a case which had a tendency to Class II



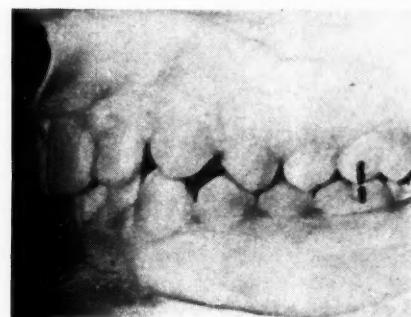
A



B



C



D

Fig. 4.—A, Tendency to Class II division 1 with 66 very carious. B, Result after extraction of 66 and treatment by intermaxillary traction, using fixed appliances. C, Tendency to Class II division 1. D, Result after extraction of 77 and treatment by removable appliance to move upper buccal segments distally, followed by oral screen.

faced with rather lengthy orthodontic treatment to move the premolars distally and retrocline the upper labial segment. Fig. 4 A shows a case where there was a tendency to Class II division 1 malocclusion. 66 were very carious. Treatment was to extract 66 and carry out intermaxillary traction, using fixed appliances. The result is shown in Fig. 4 B.

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division 1 malocclusion and radiographs revealed that 88 were both present. Treatment was to extract 77 and move the upper buccal segments distally by means of a removable appliance. Following this, an oral screen was used and the result is shown in Fig. 4 D.

3. Extraction of Lower Teeth.—When the lower arch is crowded in Class II division 1

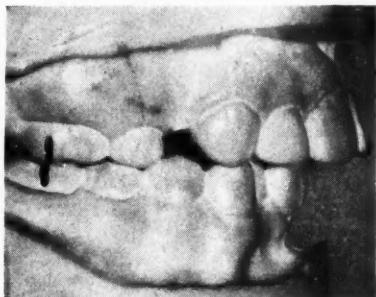
malocclusion it may be necessary to extract lower permanent teeth. Any of the lower permanent teeth may, of course, be selected for extraction, but the following principles are suggested:—

a. Incisors: When there is crowding in the lower incisor region, but no crowding in the lower buccal segments, extraction of a lower incisor is often indicated and is frequently

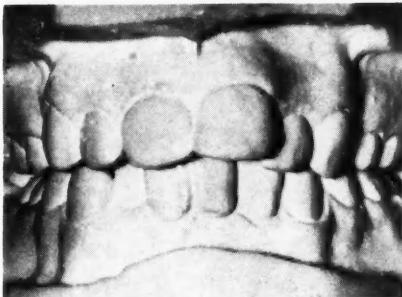
Following this, intermaxillary traction with a twin arch was used in order to retrocline the upper incisors and correct their imbrication. The result obtained is shown in Fig. 5 C, D.

b. Canines: Lower canines are extracted when they are completely blocked out vertically.

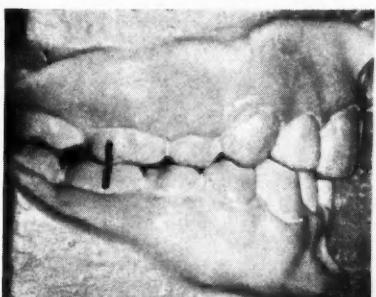
c. First premolars: Extraction of lower first premolars is indicated when there is



A



B



C



D

Fig. 5.—A, Class II division 1 with loss of $\frac{4}{4}$. No crowding in lower buccal segments. B, Anterior view showing crowding of upper and lower incisors. $\overline{1}\overline{1}$ tilted to right and $\overline{3}\overline{3}$ partly blocked out. C, Result after extraction of $\overline{1}\overline{1}$ and treatment by fixed appliance to move $\overline{2}\overline{2}$ mesially and $\overline{3}\overline{3}$ lingually, followed by intermaxillary traction, using fixed appliances with twin arch. D, Intra-oral view of result.

combined with extraction of the upper first premolars. An example is shown in Fig. 5. There was a Class II division 1 malocclusion with loss of $\frac{4}{4}$. In Fig. 5 A it will be noticed that there was no crowding in the lower buccal segments, but in Fig. 5 B it will be seen that both the upper and lower incisors were crowded. $\overline{1}\overline{1}$ had tilted to the right and $\overline{3}\overline{3}$ was partly blocked out. Treatment in the lower arch was to extract $\overline{1}\overline{1}$ and then move $\overline{2}\overline{2}$ mesially and $\overline{3}\overline{3}$ lingually by a fixed appliance.

crowding in the lower buccal segments with the lower canines proclined. Usually the extraction of lower first premolars is combined with the extraction of upper first premolars. An example is shown in Fig. 6 A. There was a tendency to Class II division 1 malocclusion together with crowding in both arches and proclination of $\frac{3}{3}$. Treatment was to extract $\frac{4}{4}$ and retrocline $\frac{3}{3}$ by means of fixed

appliances. Following this, intermaxillary traction was carried out with the extraction of $\underline{7|7}$. The result is shown in Fig. 6 B and it is interesting to note the good contact point relationship between $\underline{8|}$ and $6|$.

d. Second premolars: Lower second premolars are extracted when there is crowding

segment and would probably leave ugly gaps distal to $3|3$. Consequently, $\underline{5|5}$ were extracted and $4|4$ moved distally by means of a removable appliance. Following this, the upper incisors were retroclined by means of a further removable appliance and the result obtained is shown in Fig. 7 D.

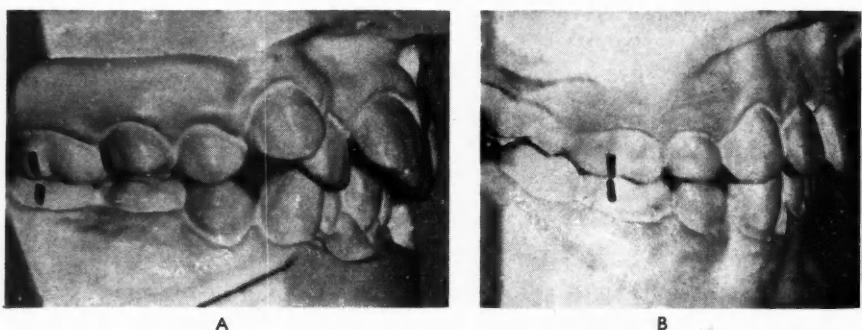


Fig. 6.—A, Tendency to Class II division 1 with crowding in both arches and proclination of $3|3$. B, Result after extraction of $\underline{4|4}$ and treatment by fixed appliances to retrocline $3|3$, followed by extraction of $\underline{7|7}$ and intermaxillary traction, using fixed appliances.

in the lower buccal segments with forward movement of lower first permanent molars, but with the lower canines not proclined. For example, Fig. 7 A shows a severe Class II division 1 malocclusion. There was crowding in the lower buccal segments with forward movement of $\underline{6|6}$, blocking out $\underline{5|5}$, but $3|3$ were not proclined. Treatment was to extract $\underline{5|5}$ and then, because the Class II division 1 malocclusion was severe, $4|4$ were extracted in order to provide adequate spaces for the retroclination of the upper labial segment. Intermaxillary traction, using fixed appliances, was carried out and the result of the treatment is shown in Fig. 7 B. Fig. 7 C shows another example, but in this case the Class II division 1 malocclusion was only mild. Again, there was crowding in the lower buccal segments with forward movement of $\underline{6|6}$, blocking out $\underline{5|5}$, but $3|3$ were not proclined. Treatment again was to extract $\underline{5|5}$. However, in this case, it was felt that, because the malocclusion was only mildly Class II division 1, extraction of $4|4$ would provide more space than was necessary for the retroclination of the upper labial

e. First molars: Lower first molars are only extracted when they are very carious or badly decalcified. When one is obliged to extract lower first molars it is almost invariably necessary to extract the upper first molars also. Fig. 8 A, for example, shows a Class II division 1 malocclusion with loss of $6|6$. Treatment was to extract $\underline{6|6}$ and the malocclusion was corrected by means of an Andresen appliance followed by an oral screen. The result obtained is shown in Fig. 8 B.

Retention.—After the active treatment of a Class II division 1 malocclusion has been completed, retention is nearly always necessary. The relapse which is most liable to occur is for the upper incisors to procline. Consequently, retention is directed towards maintaining the labial segment relationship which has been achieved. There are a variety of methods and appliances which can be used but, in practice, the following procedures have been found to be effective:

1. An attempt is made to educate the child to keep his lips together and he is encouraged to develop, as much as possible, his conscious

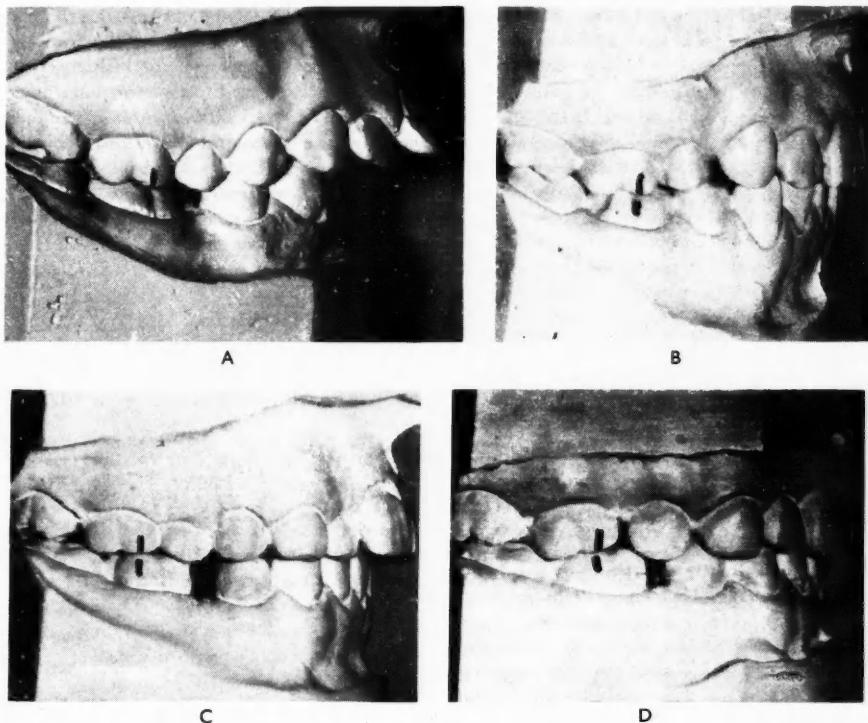


Fig. 7.—A, Severe Class II division 1 with crowding in lower buccal segments. There was forward movement of $\underline{6|6}$, blocking out $\underline{5|5}$, but $\underline{3|3}$ were not proclined. B, Result after extraction of $\frac{4}{4}$ and treatment by intermaxillary traction, using fixed appliances. C, Tendency to Class II division 1 with crowding in lower buccal segments. There was forward movement of $\underline{6|6}$, blocking out $\underline{5|5}$, but $\underline{3|3}$ were not proclined. D, Result after extraction of $\frac{5}{5}$ and treatment by removable appliances to move $\frac{4}{4}$ distally and retrocline $321|123$.

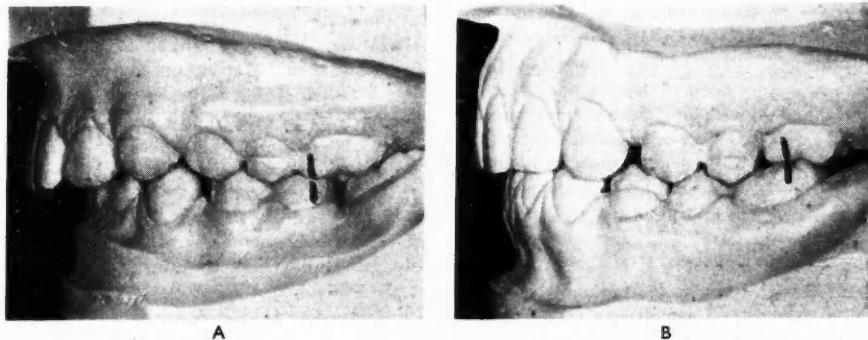


Fig. 8.—A, Class II division 1 with loss of $\underline{6|6}$. B, Result after extraction of $\underline{6|6}$ and treatment by Andresen appliance and oral screen.

control over his lip musculature. To this end, the will of the child is activated. In the case of a girl, an appeal is made to her vanity and to her sense of wanting to have a good appearance. It is explained to her that she looks much better with her lips together and that, if she fails to keep them together, her upper incisors are liable to become prominent again and give her a poor appearance. In the case of a boy, an appeal to his vanity is of little use because, at the time when treatment is usually completed, a boy is not particularly interested in his appearance. Frequently, however, it has been found that an appeal to a boy's sense of wanting to be physically efficient and "tough" is sufficient to activate his will.

2. When fixed appliances are used to correct a Class II division 1 malocclusion, they are removed as soon as the required labial segment relationship has been obtained. Then, within twenty-four hours, the child is fitted with an upper removable appliance, carrying a labial bow and a passive inclined plane, in order to retain the incisor relationship. This appliance is worn continually day and night, for at least six months. Then, an oral screen is constructed and gradually substituted for the upper removable appliance. The substitution is usually effected in this manner. The upper appliance is worn during all the day and the screen is worn for one hour in the evenings and also all night and every night. When the screen is being worn the upper appliance is, of course, removed. When the child becomes fully competent with the screen, he ceases wearing the upper appliance during the day but continues using the screen for one hour in the evenings and all night and every night. In addition, it has been found an advantage to fit a removable wire loop to the screen in order that it can be used to exercise the lips. This method of exercising the lips seems to increase the child's conscious control over them and, in practice, proves more effective than prescribing lip exercises.

3. When a Class II division 1 malocclusion is treated with removable appliances, the final tooth movement is usually to retrocline the upper incisors by means of an appliance with a labial spring. When the desired labial segment

relationship has been achieved, the labial spring is rendered passive and an oral screen constructed. Then, a gradual change to the oral screen is carried out in the same manner as described previously. Again the screen usually carries a removable wire loop in order that it may be used as an exerciser.

4. The child continues to wear the oral screen for one hour in the evenings as well as all night and every night and, in addition, he is encouraged to use the screen with the wire loop, as much as possible, in order to exercise his lips. These methods are continued until it is judged that all possible lip control has been developed. Then, the oral screen is gradually withdrawn, the exercises being ceased last.

Finally, although in this paper an attempt has been made to consider the treatment of Class II division 1 malocclusion, I think it is well to emphasize that the treatment of Class II division 1 malocclusion cannot be dissociated from the general treatment of a child's mouth. Nor, indeed, is it possible to consider the treatment of a child's mouth without considering the child himself. Sometimes, I feel, we orthodontists tend to be overspecialized and we run the danger of regarding a child's mouth as a problem in malocclusion. We are apt to forget that, fundamentally, it is a child's mouth we are dealing with and that, moreover, the mouth is only a part of the child.

That famous Newcastle upon Tyne paediatrician, the late Sir James Spence, concluded one of his papers with these words: "It must be remembered that there are no such things as diseases but only human beings suffering from disease." May I, on a much humbler plane, conclude with these words: "It must be remembered that there are no such things as Class II division 1 malocclusions but only children suffering from Class II division 1 malocclusion."

Acknowledgements.—I would like to express my grateful thanks to Mr. A. J. Finlayson, A.I.B.P., for the photography, and to the Photographic Department of the Newcastle upon Tyne Dental Hospital for permission to reproduce the illustrations.

AN INTERESTING CASE OF DEVELOPMENT*

GROWTH IN WIDTH OF THE MAXILLARY ARCH BETWEEN 8-11·9 YEARS

By JOAN WEYMAN, B.D.S., F.D.S., D.Orth. R.C.S.

THE patient was aged 8 years when first seen in January, 1951. Her occlusion was Angle's Class I with some tendency to Class III. There was a cross-bite of all the left cheek teeth,

place (Fig. 2). There was no longer a cross-bite present, nor was 2 in lingual occlusion. A considerable increase in width of the arches had occurred, more so in the maxilla than in

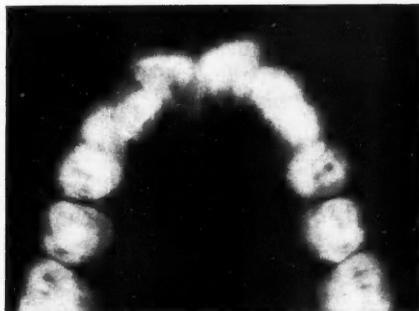


Fig. 1.—On January 19, 1951, aged 8 years.

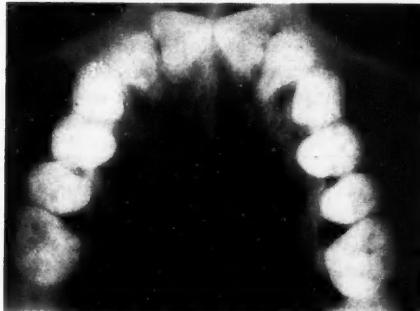


Fig. 2.—On October 28, 1954, aged 11 years 9 months.

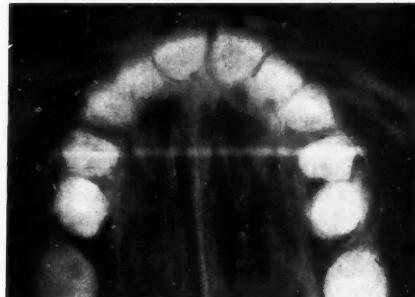
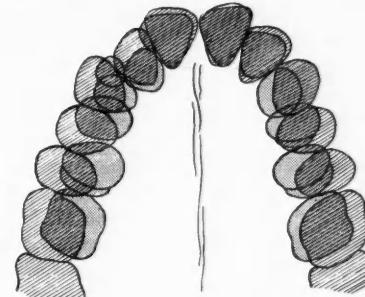


Fig. 3.—Check for accuracy.

2 was blocked out in lingual occlusion, and there was also some irregularity of the other maxillary incisors (Fig. 1). Radiographs were taken at the time but no models, and she was then put on the orthodontic waiting list.

She was not recalled for treatment until October, 1954, and she assured us that she had had no orthodontic treatment meanwhile. It was found that a great change had taken



■ AGED 8 YRS. ■ AGED 11·9 YRS.
Fig. 4.—Superimposed tracings of enlargements of the occlusal radiographs.

the mandible. The incisors were so much improved that it was felt that no treatment of the malocclusion was necessary. The occlusal radiographs were repeated and it was found that the increase in width, measuring the external 66 distance on the two radiographs, was 6 mm.

It was of importance to know that the radiographs accurately portrayed the width of the arch, both because the measurements

* Read at the meeting of the British Society for the Study of Orthodontics held at Newcastle upon Tyne on Saturday, May 12, 1956.

were compared and as they were to be used for superimposed tracings. To check this, another patient was radiographed using slightly different angulations, but as far as possible duplicating the views taken of the original patient. These films had fastened to each of them in the transverse direction (i.e., across the arch) a strip of metal of exactly the same length, and the resulting radiographs were compared for the length of this metal strip (*Fig. 3*). As they were of identical length it was assumed that in these views there was no distortion of the arch width.

The enlargements which were to be traced were made on glass negatives and traced

directly off these, as it was found that there was considerable distortion in making positive prints on paper. The tracings were superimposed over the mid-point between the two central incisors and oriented on the medium septum as far as possible (*Fig. 4*).

The first radiograph of the mandibular arch of this patient was not found suitable for tracing or measuring, so it was not possible to show the change in this arch.

I should like to thank the Radiographic and Photographic Departments of the Newcastle upon Tyne Dental Hospital for the trouble they took with this case.

BOOK REVIEWS

APPLIED DENTAL MATERIALS. By J. N. ANDERSON, B.D.S. (Sheff.), Lecturer in Dental Mechanics and Dental Prosthetics, University of St. Andrews. $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 422 + x, with 31 illustrations. 1956. Oxford: Blackwell. 37s. 6d.

In writing of dental materials a difficult decision has to be taken as to the amount of detail that should be given of their physics and chemistry, for, without some information of this sort, the book becomes a recital of empirical dicta. On the other hand, the fundamental data themselves are so interesting that the temptation to pursue the analysis is difficult to resist. A further complication is that the relation between laboratory analysis and clinical behaviour is often very subtle, and important distinctions can easily be oversimplified. In this present book the author shows himself as a very vigorous and effective teacher. His exposition is clear and convincing, well supported by an economic and pleasing style. (It is altogether out of character when he succumbs to contemporary ill-usage and says "indicated" when he means "suitable".) The decision as to the level of explanatory detail is taken with admirable discretion and executed with great skill—only rarely does the condensation fail, as, for instance, when some confusion appears in the discussion of super-lattices and intermetallic compounds—not

an easy discussion in any case. It is a pleasure to welcome and recommend what cannot fail to be a very strong runner from the Scottish stable.

S. F. F.

THE DENTAL TREATMENT OF MAXILLO-FACIAL INJURIES.

By SIR WILLIAM KELSEY FRY, C.B.E., M.C., M.D.S. (Durham), D.Sc. (McGill), F.R.C.S., F.D.S. (Eng.), and TERENCE GEORGE WARD, M.B.E., F.D.S. R.C.S. (Eng.), L.R.C.P., L.R.C.S. (Edin.). Second edition. Pp. 372 + xi, with 383 illustrations. 1956. Oxford: Blackwell Scientific Publications. 47s. 6d.

The first edition of this book, published in 1942, was of unique value to the profession and it quickly ran into four impressions. The supplement, which was published in 1943 to amplify the principles laid down in the parent volume, has now been discontinued as such and has been incorporated in the second edition. Three of the original authors have now left the field of maxillo-facial surgery and their place has been taken by Mr. Terence Ward, Consultant Dental Surgeon at the Queen Victoria Hospital, East Grinstead.

The second edition has been enlarged by the revision of several chapters and the addition of chapters by Sir Archibald McIndoe on "Fractures of the Middle Third of the Face" and by Mr. Ivor R. H. Kramer on

"Sulphonamide and Antibiotic Therapy". These are valuable contributions and should further enhance the reputation of the book as an essential both for the undergraduate and those seeking higher qualifications.

The authors are to be congratulated on their ability to pack such an enormous amount of useful information into a volume of reasonable proportions, and it is good to see that no space has been allotted to theories and surgical techniques which have been superseded. The chapter on the reduction and fixation of fractures of the mandible has been extensively revised. The control of fragments by bone wiring is amply described and well illustrated. The style of the book is lucid and the authors are obviously writing from vast personal experience. The publishers are to be congratulated on the abundance of illustrations and the excellent quality of the production in a book of reasonable price. D. M.

THE AETIOLOGY OF IRREGULARITY AND MALOCCLUSION OF THE TEETH. Second edition. Part I by JAMES COUPER BRASH, M.C., M.A., M.D., D.Sc., L.L.D., F.R.C.S. (Edin.), Emeritus Professor of Anatomy, University of Edinburgh. Part II by H. T. A. McKEAG, B. Dent. Sc., F.D.S. R.C.S., D. Orth. R.C.S., Reader in Orthodontics, The Queen's University, Belfast; and JAMES H. SCOTT, M.D., B.Sc., L.D.S., Lecturer in Anatomy for Dental Students, The Queen's University, Belfast. With an Appendix concerning Orthodontic Problems and their Solution by MIRIAM L. TILDESLEY, M.B.E., formerly Curator of Human Osteology, Royal College of Surgeons' Museum. $9\frac{5}{8} \times 6\frac{1}{8}$ in. Pp. 503 + xvi, with 224 illustrations. 1956. London: The Dental Board of the United Kingdom. 42s.

The last publication of the Dental Board is the new edition of the well-known lectures of Professor Brash. The original lectures, given in 1929, are reprinted in full and form the four chapters of Part I of the second edition, while McKeag and Scott have contributed Part II (200 pages). Miss Tildesley's appendix: "Concerning Orthodontic Problems and Their Solution", is also wisely reprinted; a 30-page

bibliography completes the volume. The clear type is a definite improvement on the first edition, an internationally recognized standard work. With the addition of Part II the book will maintain its reputation for a long time, because the new authors have continued Brash's high standard of critical impartiality and the two parts form a complementary whole.

The new volume reviews relevant literature since 1929, continuing Brash's work, and introducing clearly and concisely matter not readily available to the average student. Quotations are no longer, nor more numerous, than is absolutely necessary and the temptation to follow them with "in other words" has been overcome.

The new authors have written separate summaries which illustrate the different approach to the subject by a clinician and an anatomist: McKeag is immediately concerned with the overall problem of the malocclusion and comparative degree of activity and importance of the various aetiological factors in the individual, while Scott presents the individual basic factors, as far as he is able to recognize and assess them, and uses them as a basis for his arguments. These different approaches are in no way antagonistic, but complementary.

It is undoubtedly the best book in this field, with a wealth of material, well produced, easily read, and remarkably cheap at 42s. It can be recommended to all students of orthodontics and is a "must" for post-graduates.

H. E. W.

THE DENTAL BUSINESS OFFICE. By C. EDWARD RUTLEDGE, D.D.S., and EDWARD H. WINSOR. $7\frac{3}{4} \times 5\frac{1}{4}$ in. Pp. 152. 1956. London: Henry Kimpton. 26s.

This book on the business side of dentistry is written largely for an American audience. The average practitioner in this country will find most of the book quite unreal in regard to his own running of a dental practice under the N.H.I. scheme. However it is full of sound ideas and gives an interesting account of the business problems and their solutions in an American dental practice. N. L. W.

ABSTRACTS FROM OTHER JOURNALS

Varied Applications of Direct Pin Inlays

Gingival erosion often extends beyond the line angles of the tooth so that the only means of retention are at the occlusal and gingival cavity walls, and this is inadequate. Using a No. 700 cross-cut tapering fissure bur, two parallel pin-holes are made at the greatest axial depth of the eroded area at points 1 mm. from both the mesial and distal root surfaces.

The pin-holes are 1·5 mm. deep. The cavity is now completed in the usual way.

A wax pattern is now taken and wax must be made to flow into the pin-holes. Lubricate the preparation thoroughly and blow away the excess, leaving only a thin film. Wax is to be forced into the pin-holes and this is accomplished by using a pointed instrument the end of which is slightly smaller than the No. 700 bur. Such an instrument can be made from a No. 5 explorer. If the instrument is heated half an inch from the tip wax will be forced to the bases of the pin-holes when it is pushed through the wax which already fills the cavity. This is to be repeated several times. If, when the pattern is removed, a wax-pin breaks it means the lubrication has been insufficient or that the pin-holes are not parallel. The pin-holes are filled with fine wisps of cotton-wool before filling the cavity with temporary cement. Investing and casting are carried out in the usual way as soon as possible and 22 carat gold is recommended.

The method can be adapted to other types of preparations where pin-retention is indicated.—LAMB, R. T. (1956), *J. Canad. dent. Ass.*, **22**, 282.

The Quantitative Comparison of Subgingival Curettage and Gingivectomy in the Treatment of Periodontitis Simplex

Six patients had pockets in the posterior regions of teeth which on one side of the mouth were treated by gingivectomy and on the other side by curettage.

Assessment was made one month after treatment by using pocket measurements, study models, and standardized bite-wing

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X-rays. In making the pocket measurements, six aspects of each tooth were measured. Standardization of the X-rays was achieved by constructing a special appliance which fixed over the cone of the X-ray machine carrying on an extension a pair of forceps in which both a composition bite and an X-ray film were positioned. This appliance is clearly illustrated in the paper. The study models were used to make measurements from the crest of the gingivæ to the tip of the tooth cusps.

It was shown at the termination of the observation period of one month that the operation of gingivectomy had consistently reduced pocket depth to a greater amount than curettage.—BENJAMIN, E. M. (1956), *J. Periodont.*, **27**, 144.

The Antibacterial Effects of Some Dental Restorative Materials

The antibacterial action of a number of dental restorative materials against *Lactobacillus casei*, *Clostridium biformentans*, and *Streptococcus viridans*, selected as organisms most commonly associated with dental caries, has been studied. It was found that all of the materials tested showed an antibacterial action of some degree, the effect varying with the test organism and the culture medium used. Copper amalgam was found to be most effective, and in order of decreasing potency were copper cement, gold foil, silver amalgam, zinc phosphate, silicate cement, inlay gold, and quick setting acrylic.—SHAY, D. E., ALLEN, T. J., and MANTZ, R. F. (1956), *J. dent. Res.*, **35**, 25.

Conditions influencing the Incidence of Occlusal and Interstitial Caries in Children

The incidence of caries on the occlusal and interstitial surfaces of teeth appears to be under the influence of independent factors. However, caries at these sites appears to be affected equally by the individual's susceptibility, by institutional life, and by fluorine. Spacing considerably reduces interstitial caries even when only a narrow space exists.—PARFITT, G. J. (1956), *J. Dent. Child.*, **23**, 31.